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Scheller et al.

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(45) **Date of Patent: Oct. 3, 2017**

(54) **CANNULA INGRESS SYSTEM**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 6 days.

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(65) **Prior Publication Data**

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Related U.S. Application Data

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(51) **Int. Cl.**

A61M 3/02	(2006.01)
A61F 9/007	(2006.01)
A61M 39/22	(2006.01)
A61B 17/34	(2006.01)

(52) **U.S. Cl.**

CPC ***A61M 3/0283*** (2013.01); ***A61F 9/007*** (2013.01); ***A61M 39/22*** (2013.01); *A61B 17/3421* (2013.01); *A61B 17/3462* (2013.01); *A61M 2205/582* (2013.01)

(58) **Field of Classification Search**

CPC A61B 17/3421; A61B 17/3498; A61B 2017/3482; A61B 2217/005; A61B 2217/007; A61B 17/3462; A61F 9/007; A61M 2205/582; A61M 39/22; A61M 3/0283

See application file for complete search history.

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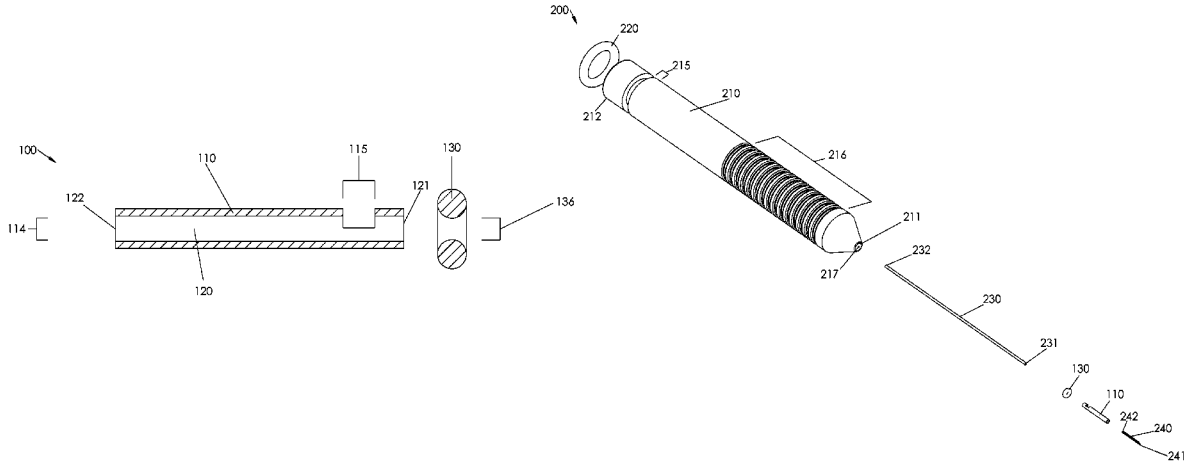
(57) **ABSTRACT**

A cannula ingress system may include a tip stabilization mechanism having a tip stabilization mechanism distal end and a tip stabilization mechanism proximal end, a fixation mechanism, a hypodermic tube having a hypodermic tube distal end and a hypodermic tube proximal end, and a tip having a tip distal end and a tip proximal end. The tip may be disposed within the hypodermic tube wherein the tip distal end extends from the hypodermic tube distal end. The fixation mechanism may be disposed within a fixation mechanism channel of the tip stabilization mechanism. The tip stabilization mechanism may be disposed over the tip and the hypodermic tube distal end.

20 Claims, 29 Drawing Sheets



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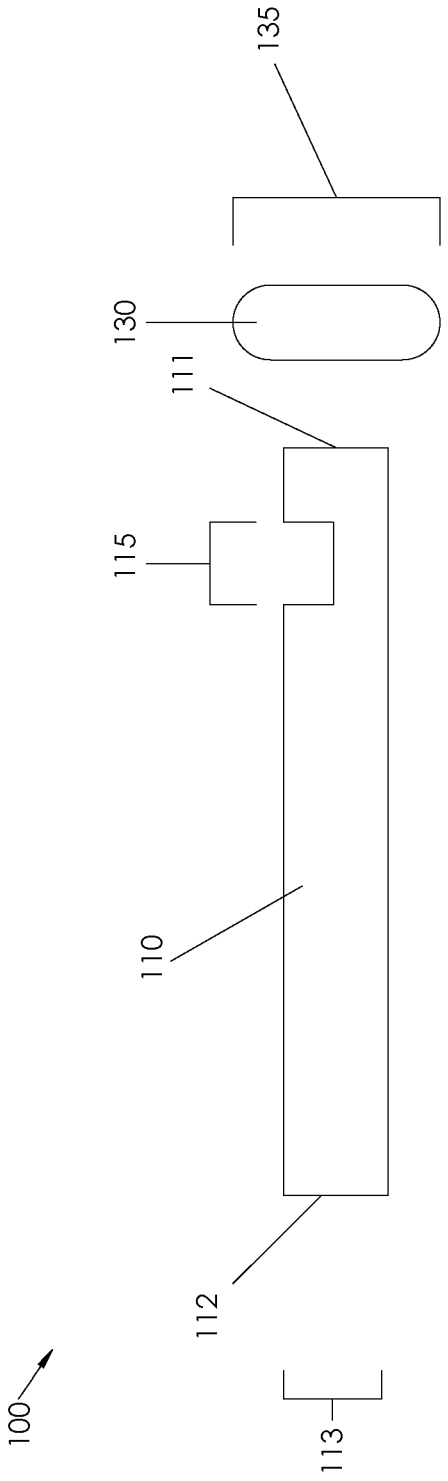
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FIG. 1A

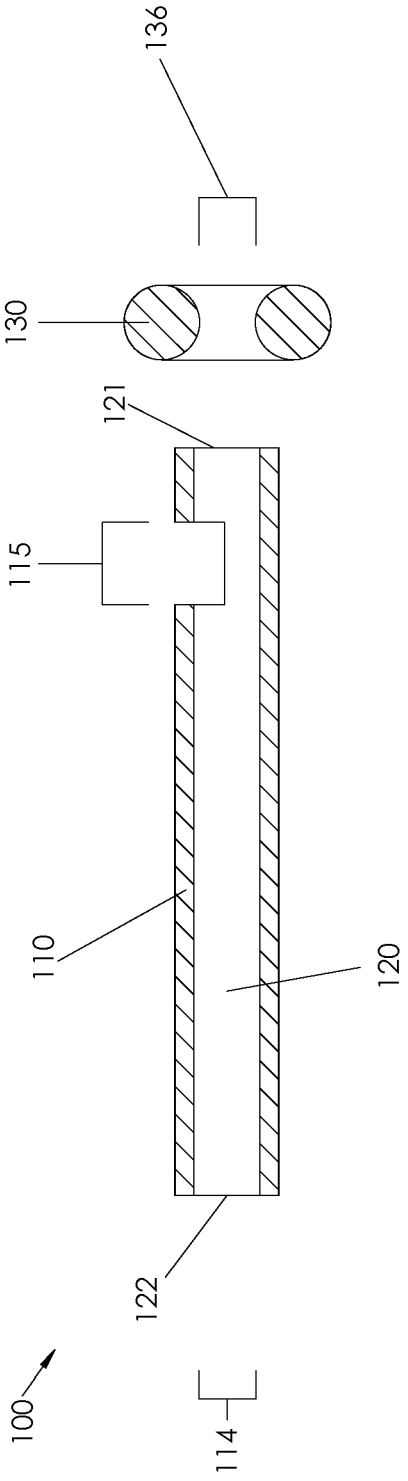
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FIG. 1B

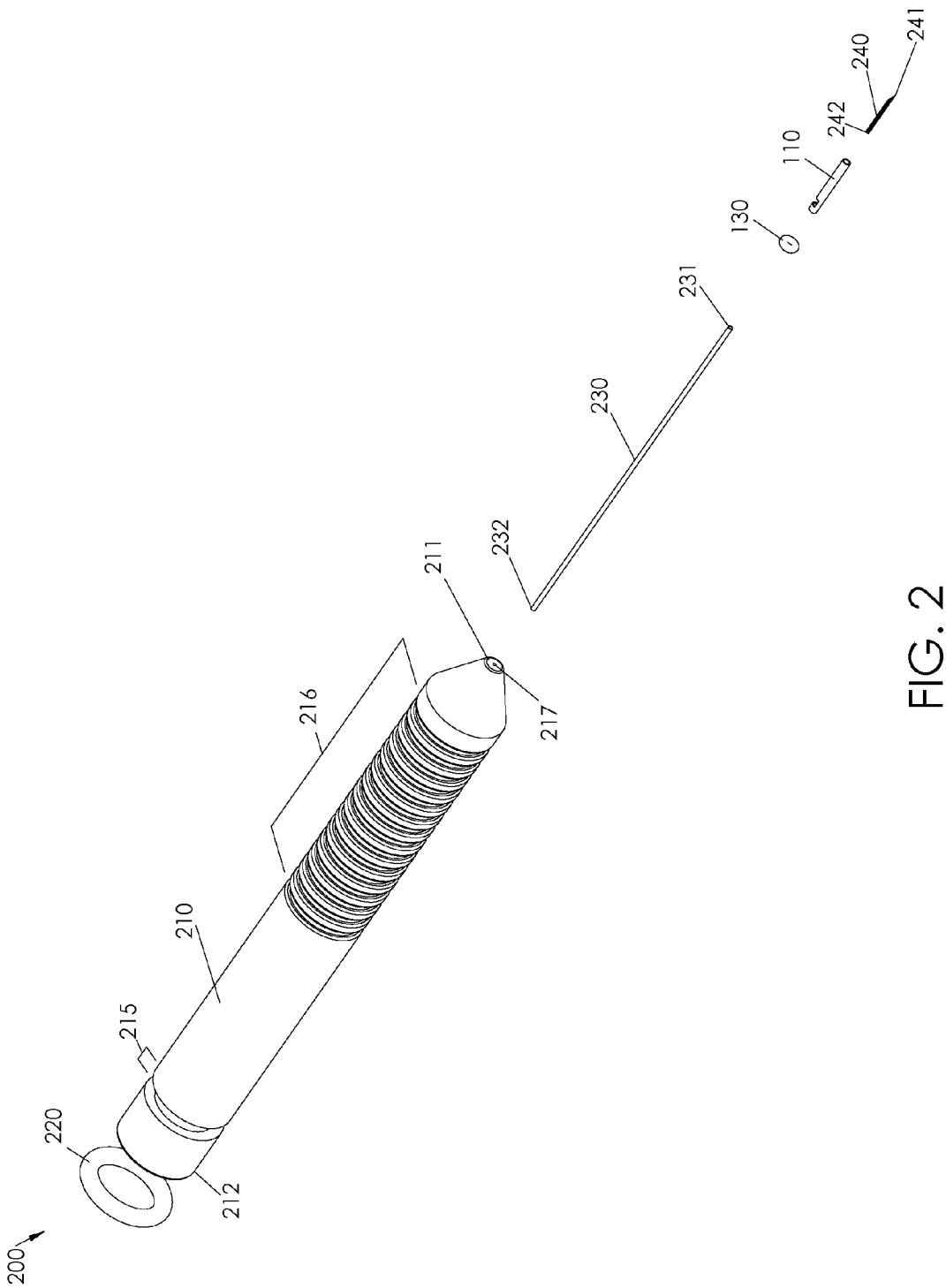

FIG. 2

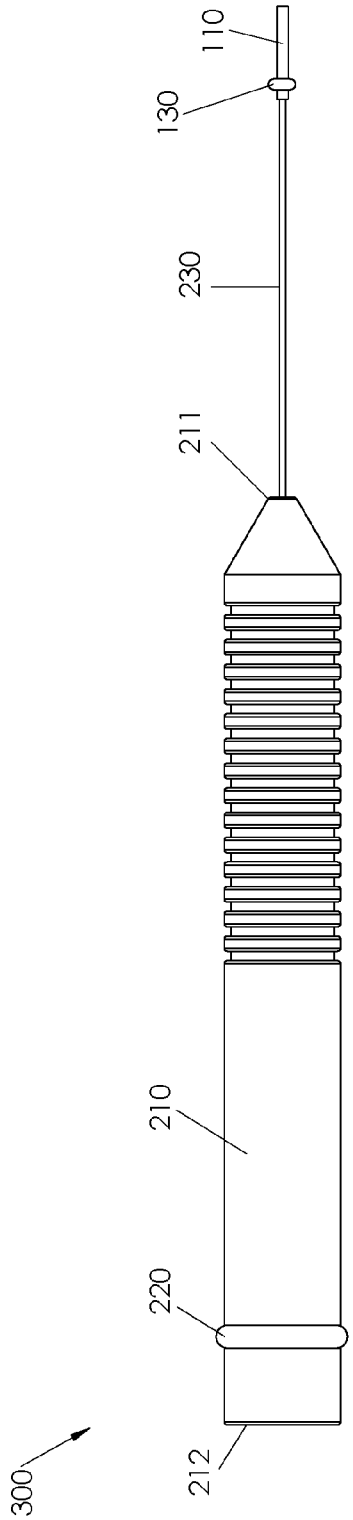
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FIG. 3A

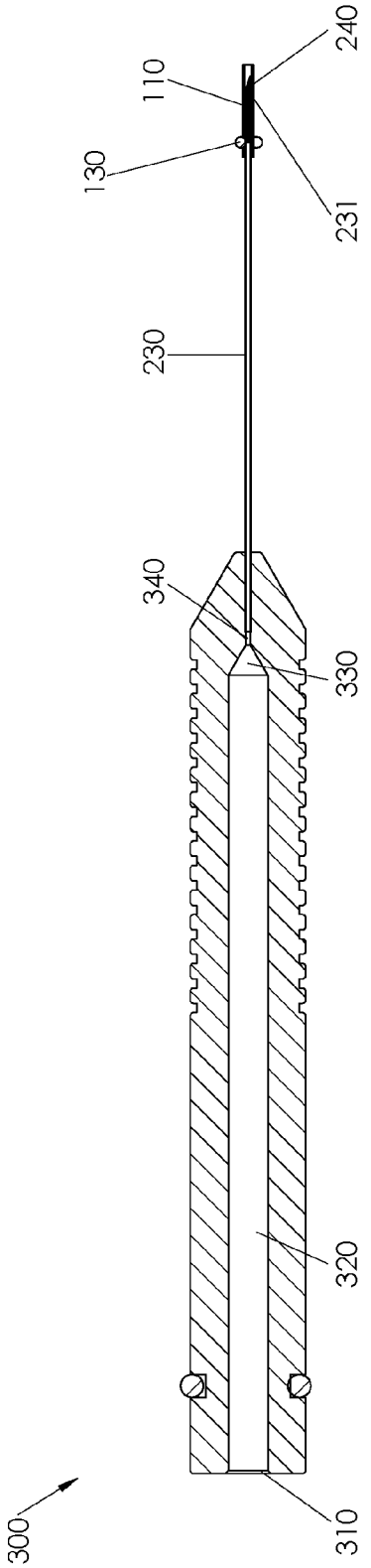
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FIG. 3B

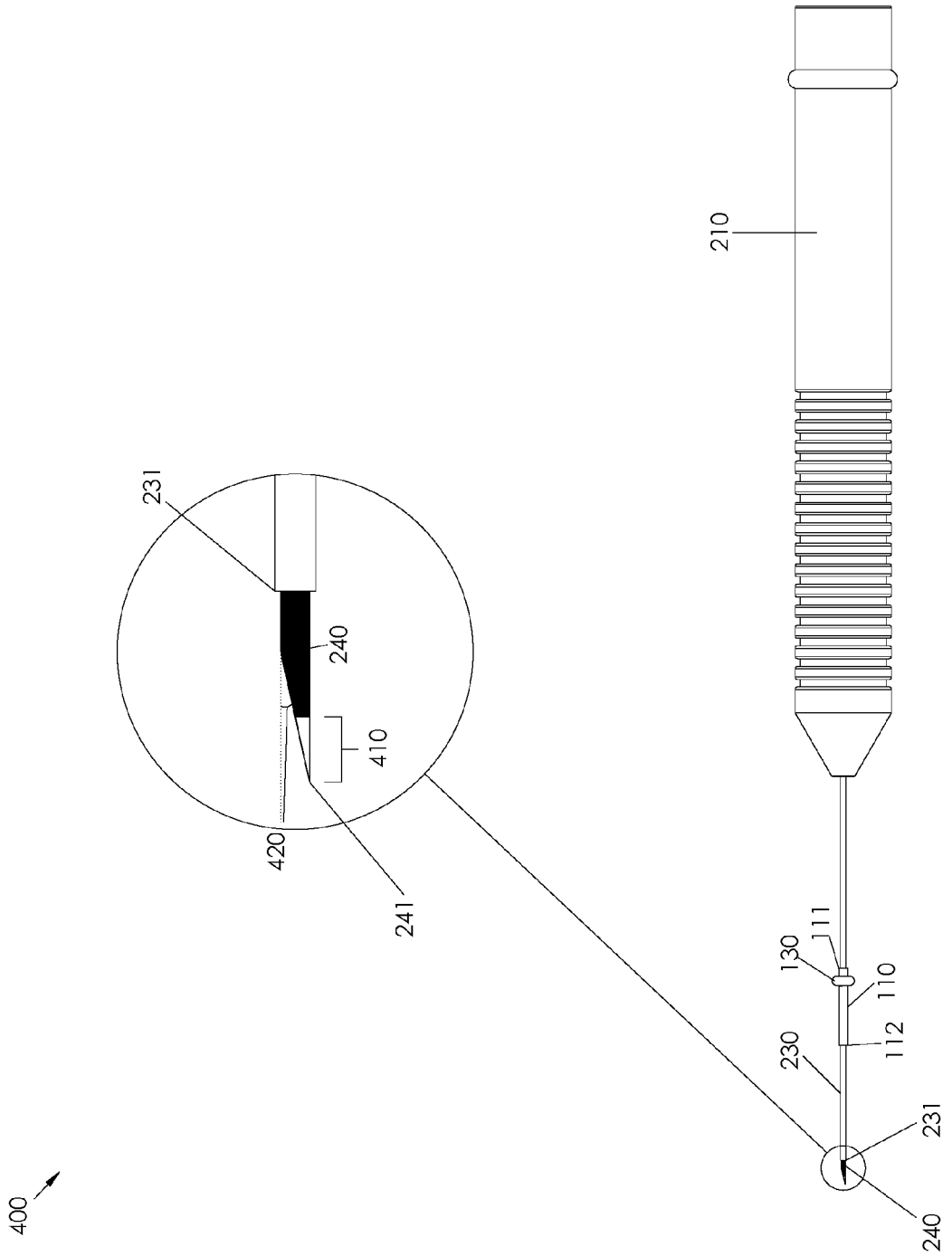

FIG. 4

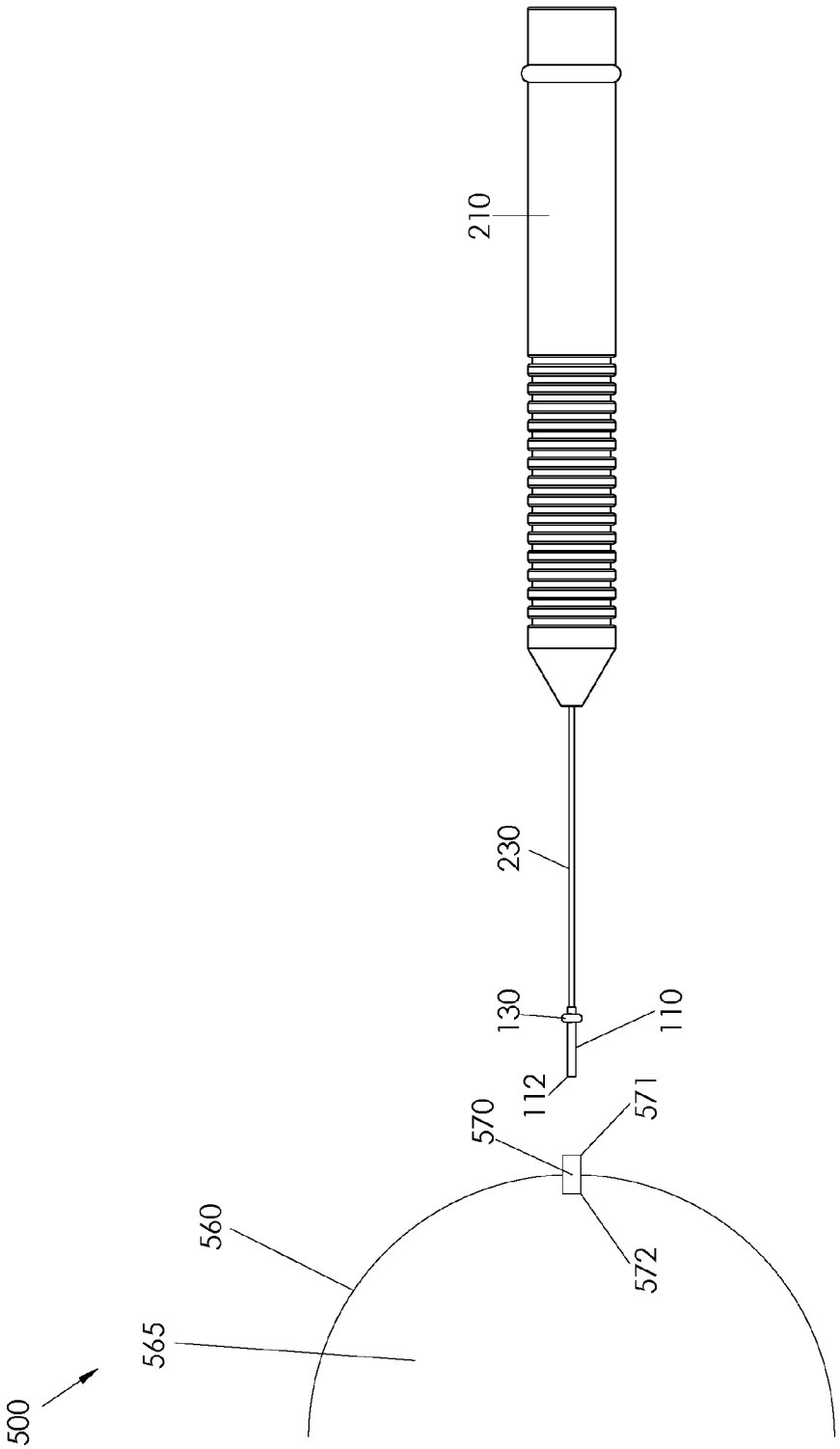

FIG. 5A

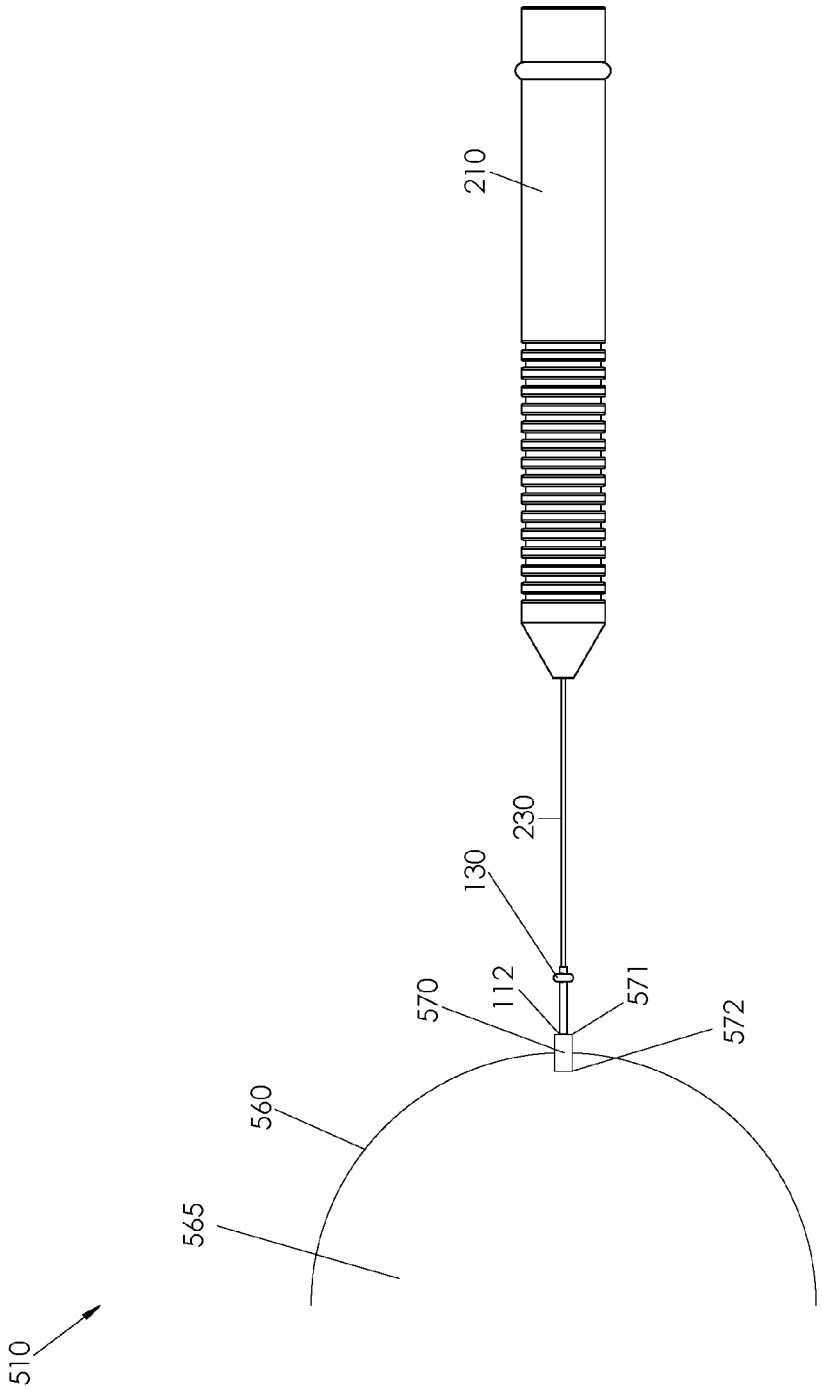

FIG. 5B

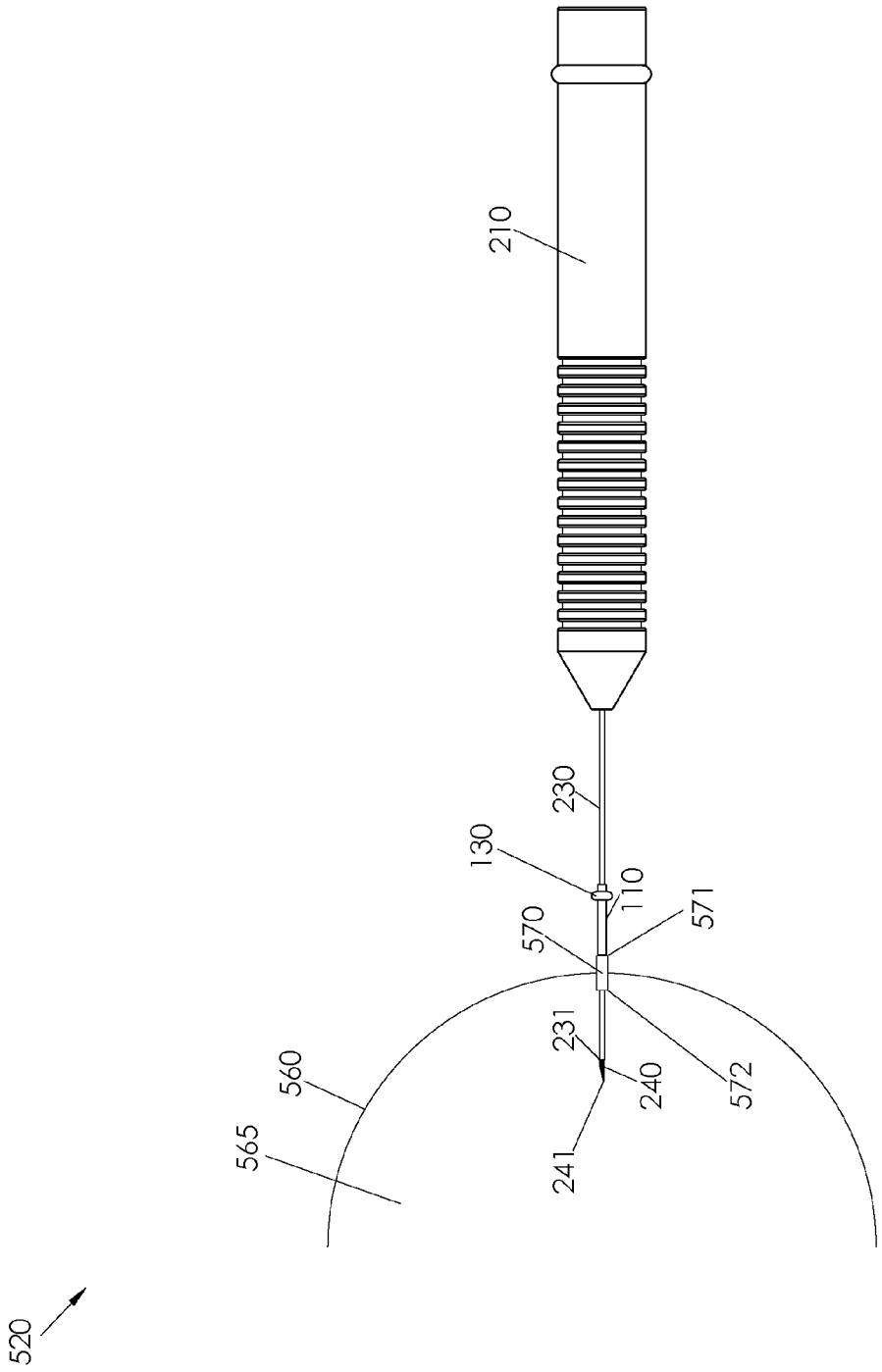

FIG. 5C

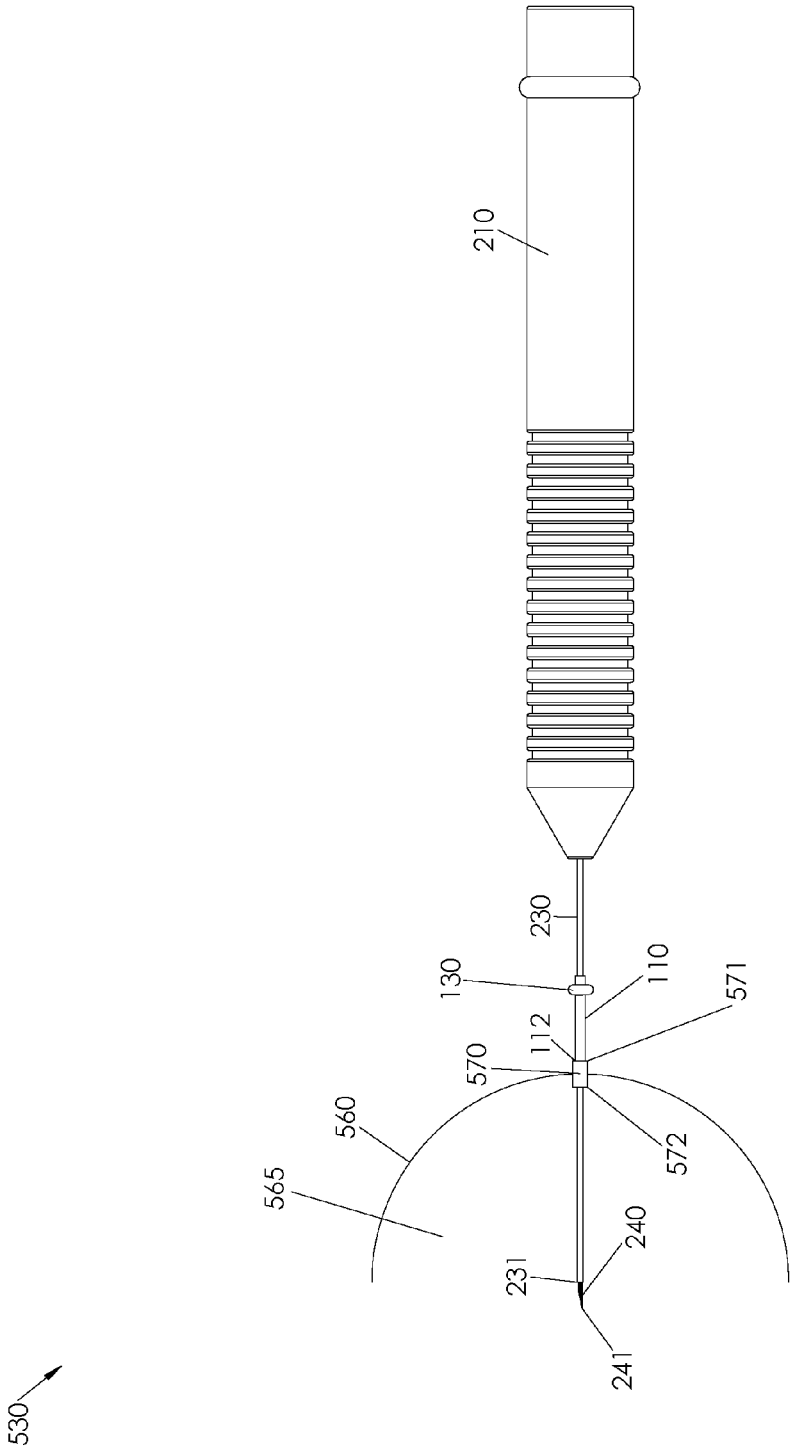

FIG. 5D

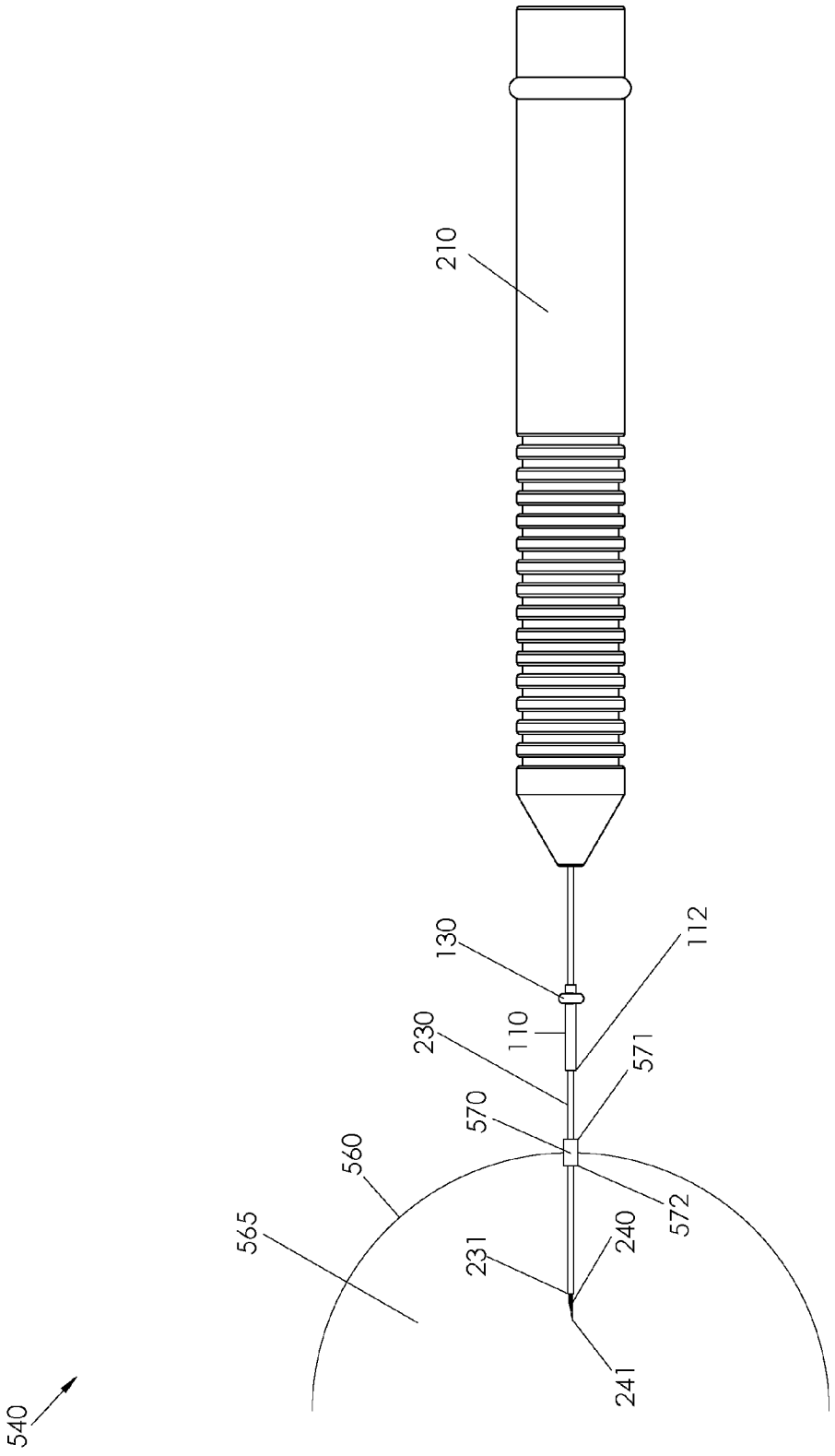

FIG. 5E

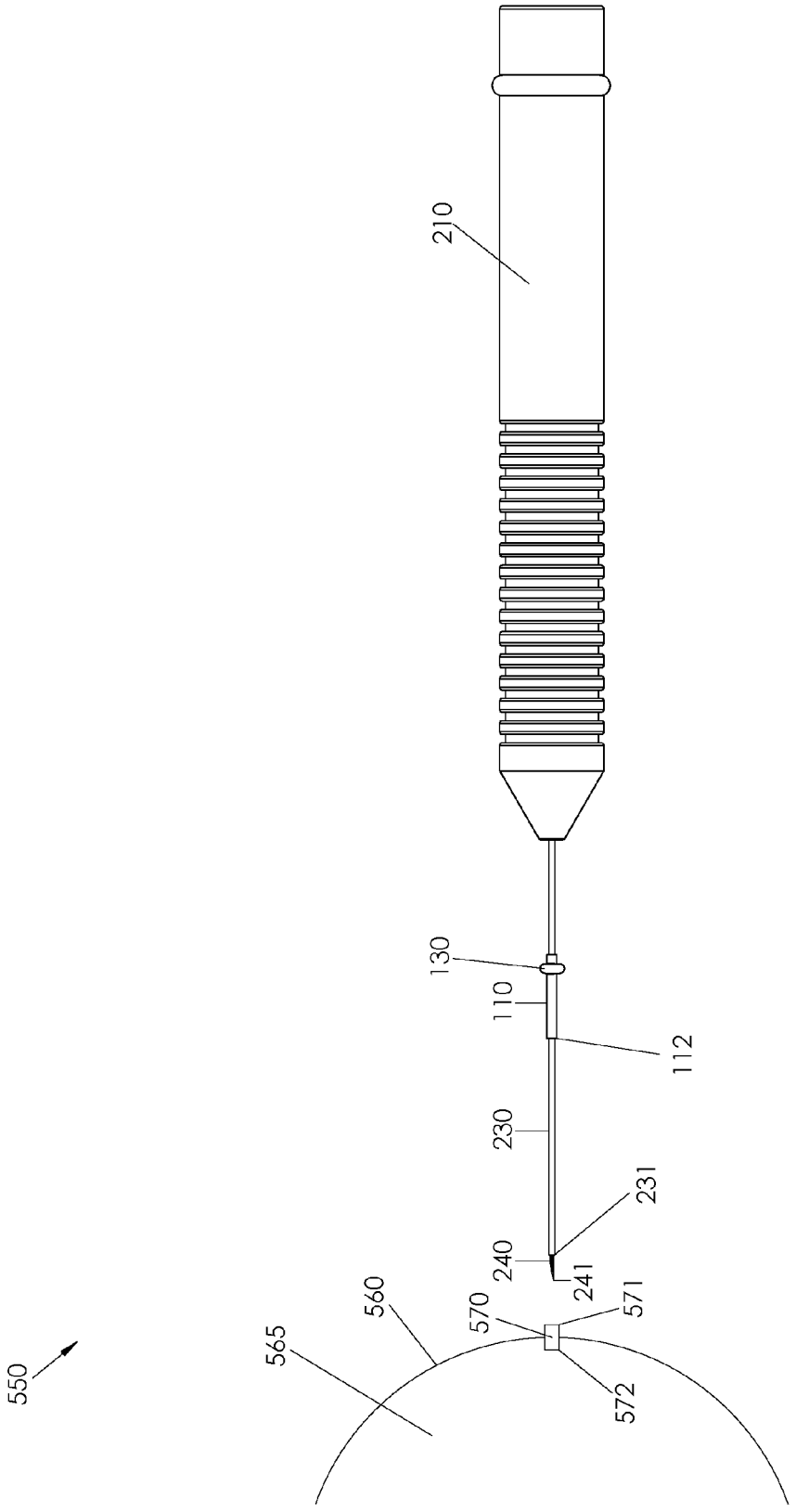

FIG. 5F

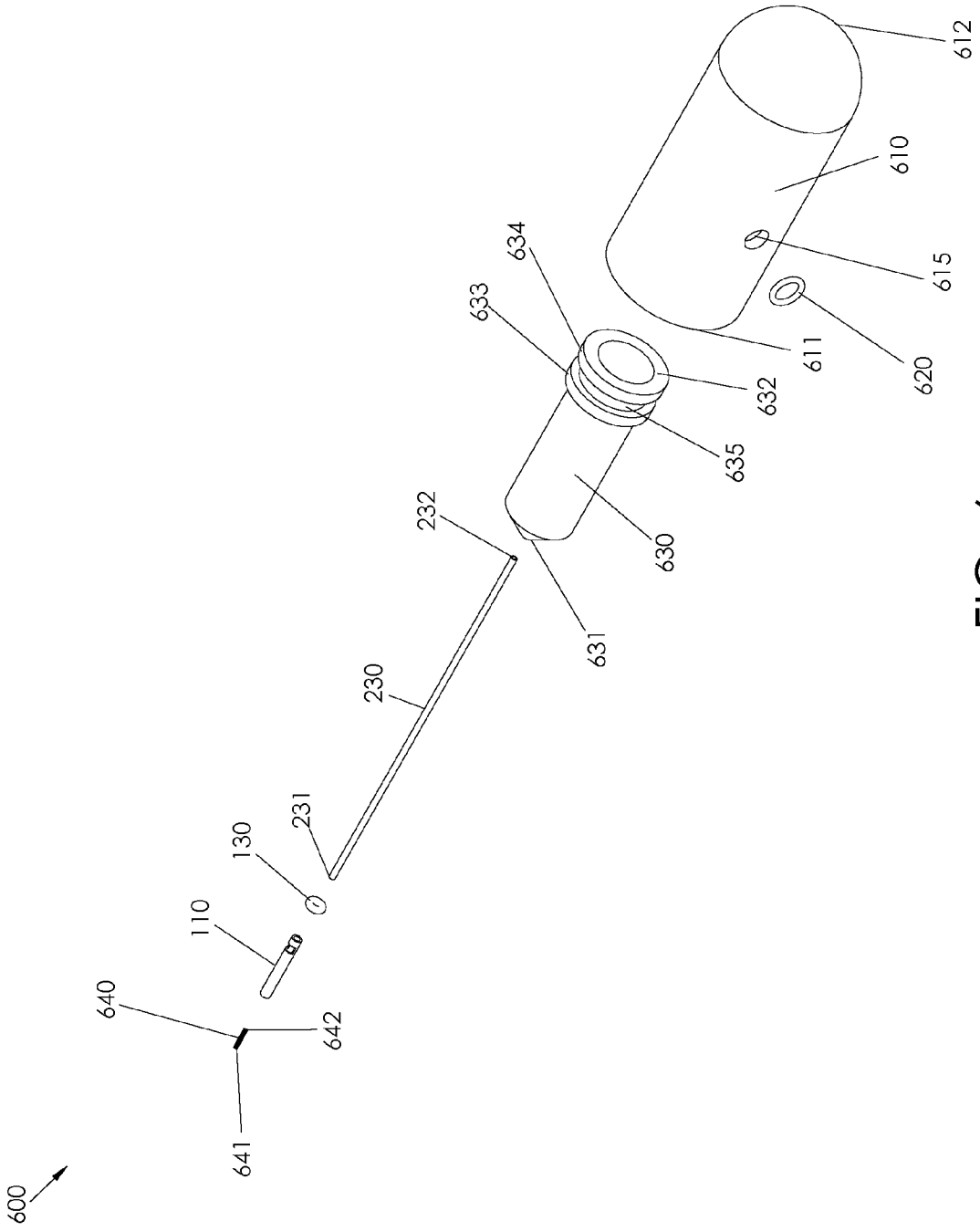
600
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FIG. 6

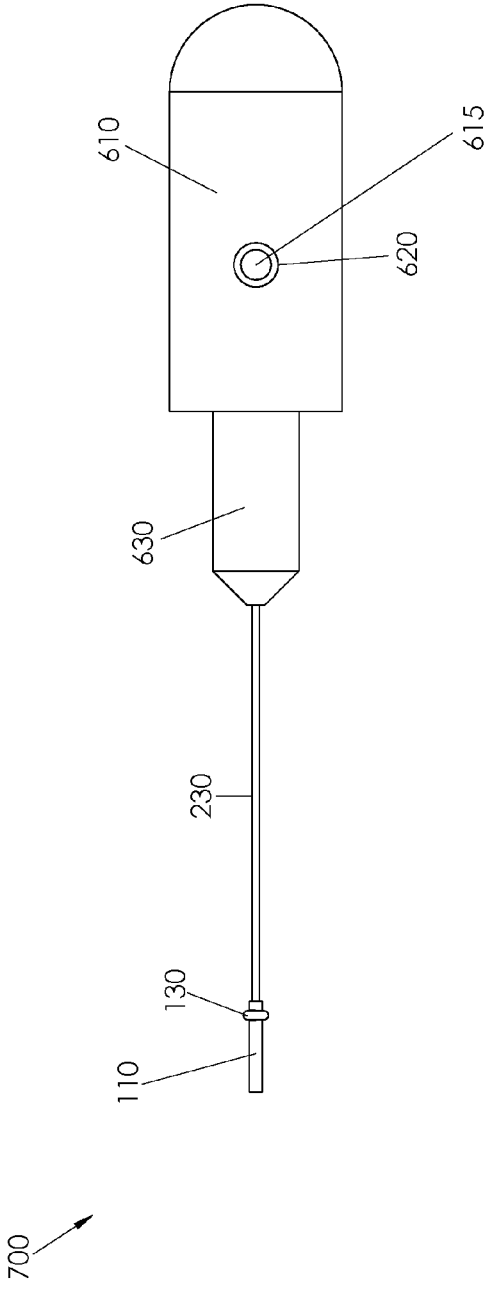
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FIG. 7A

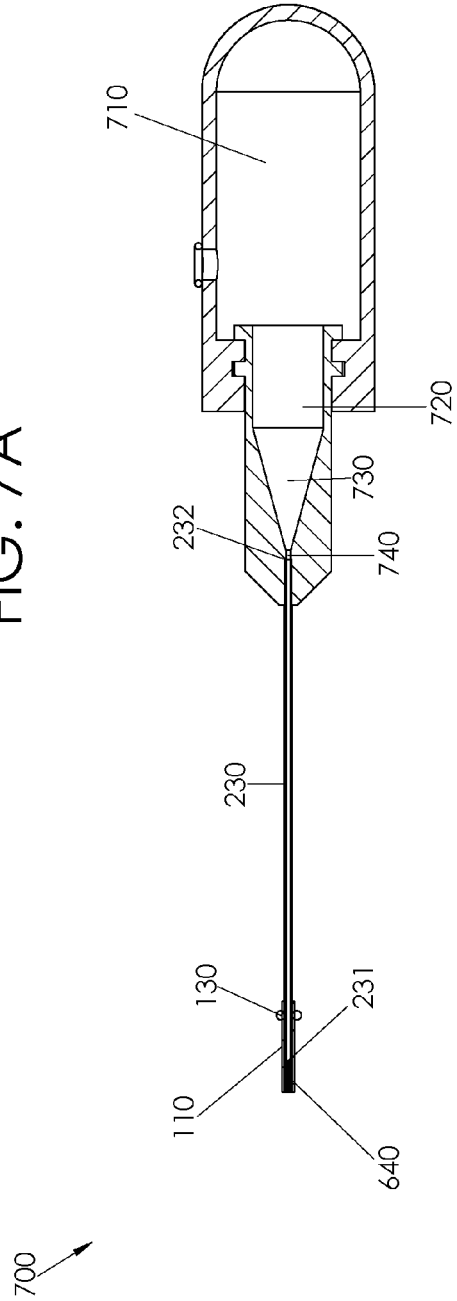
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FIG. 7B

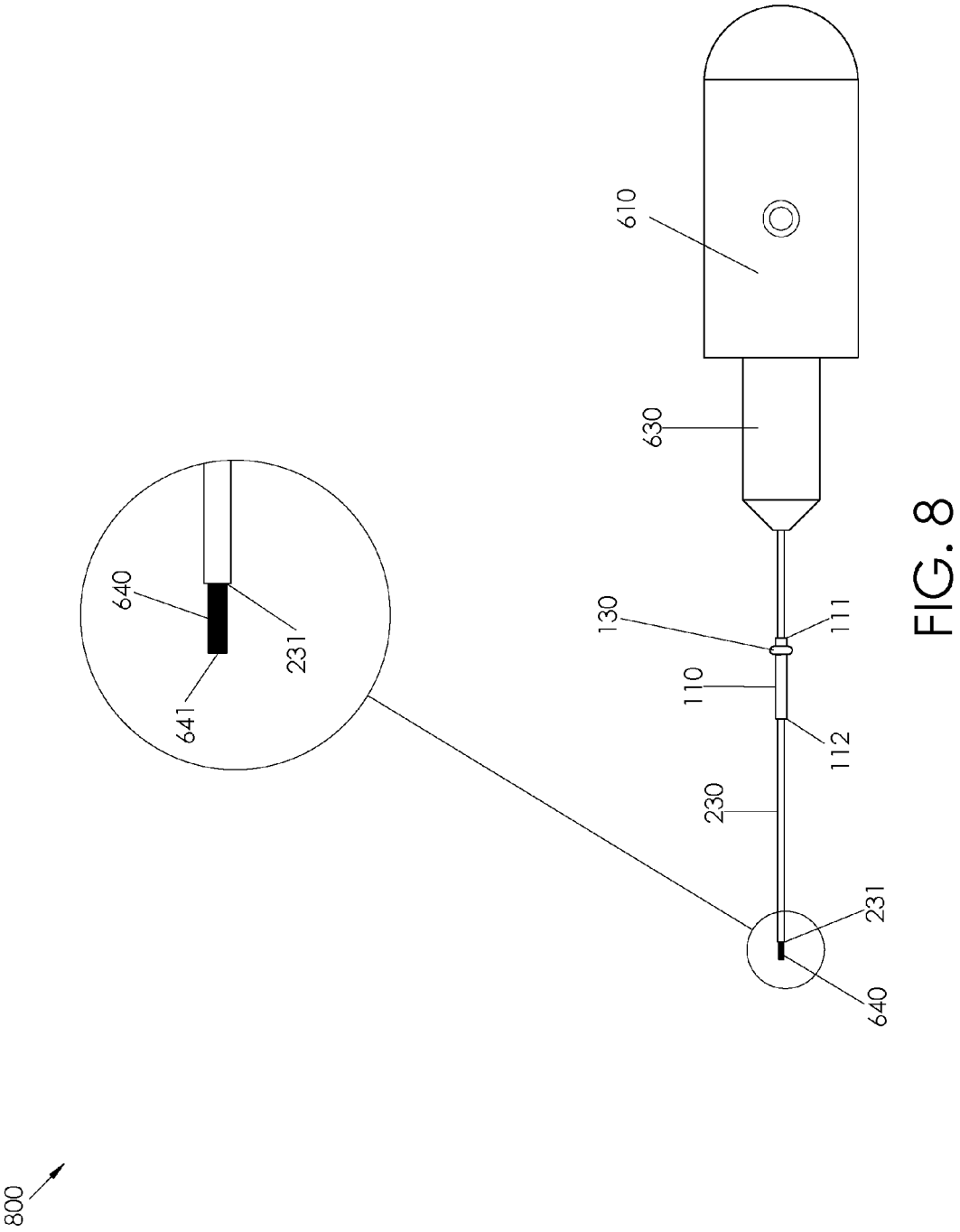


FIG. 8

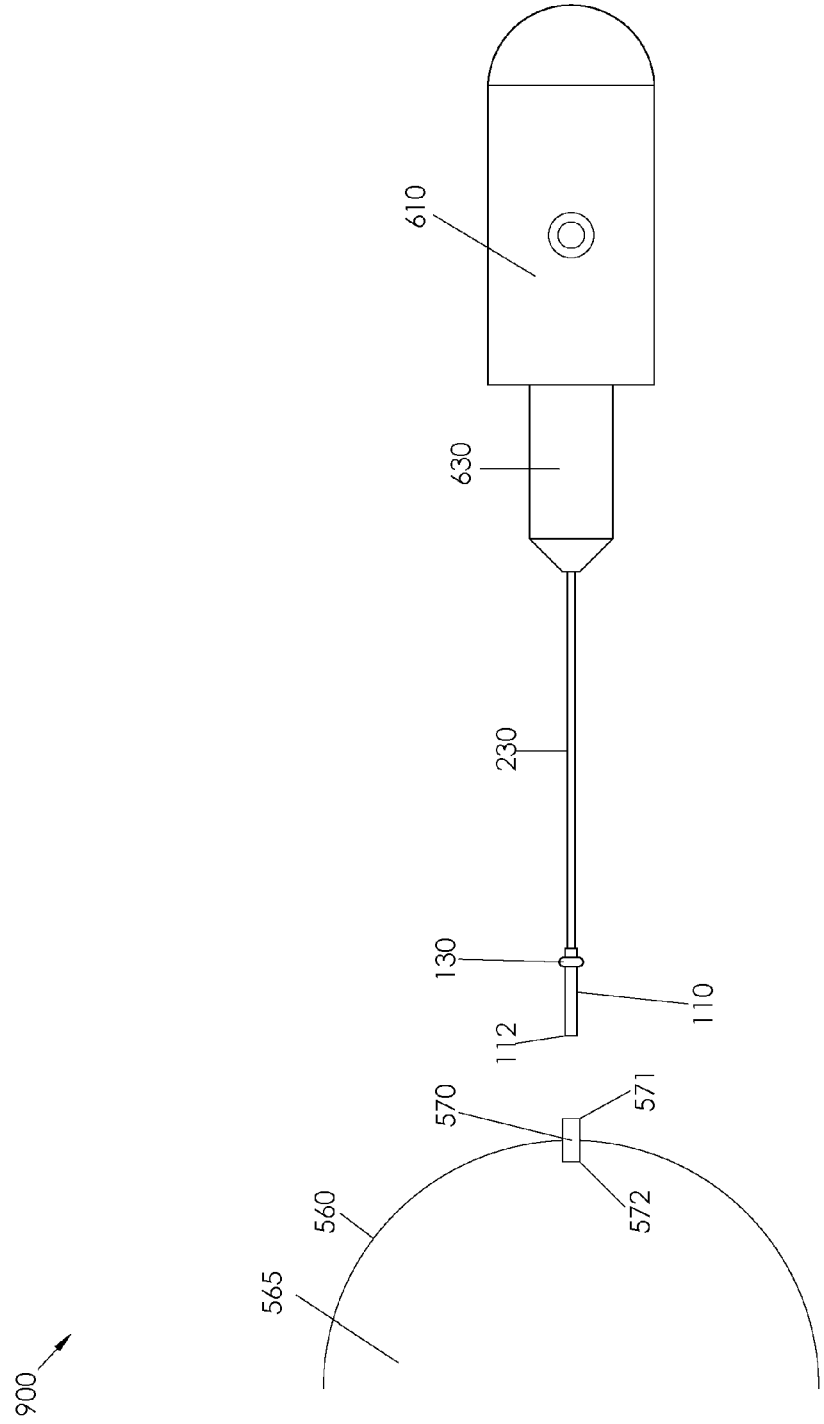


FIG. 9A

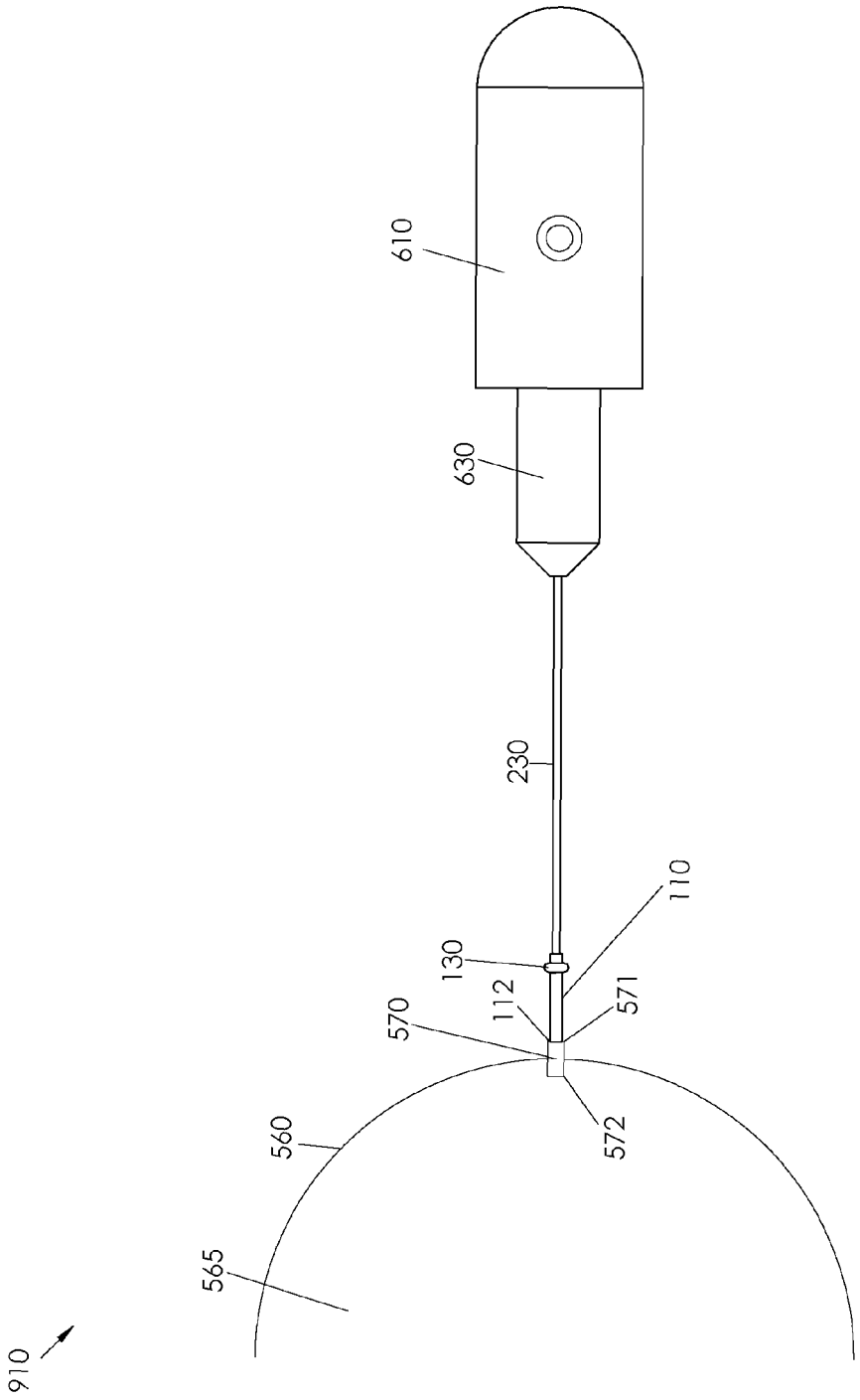
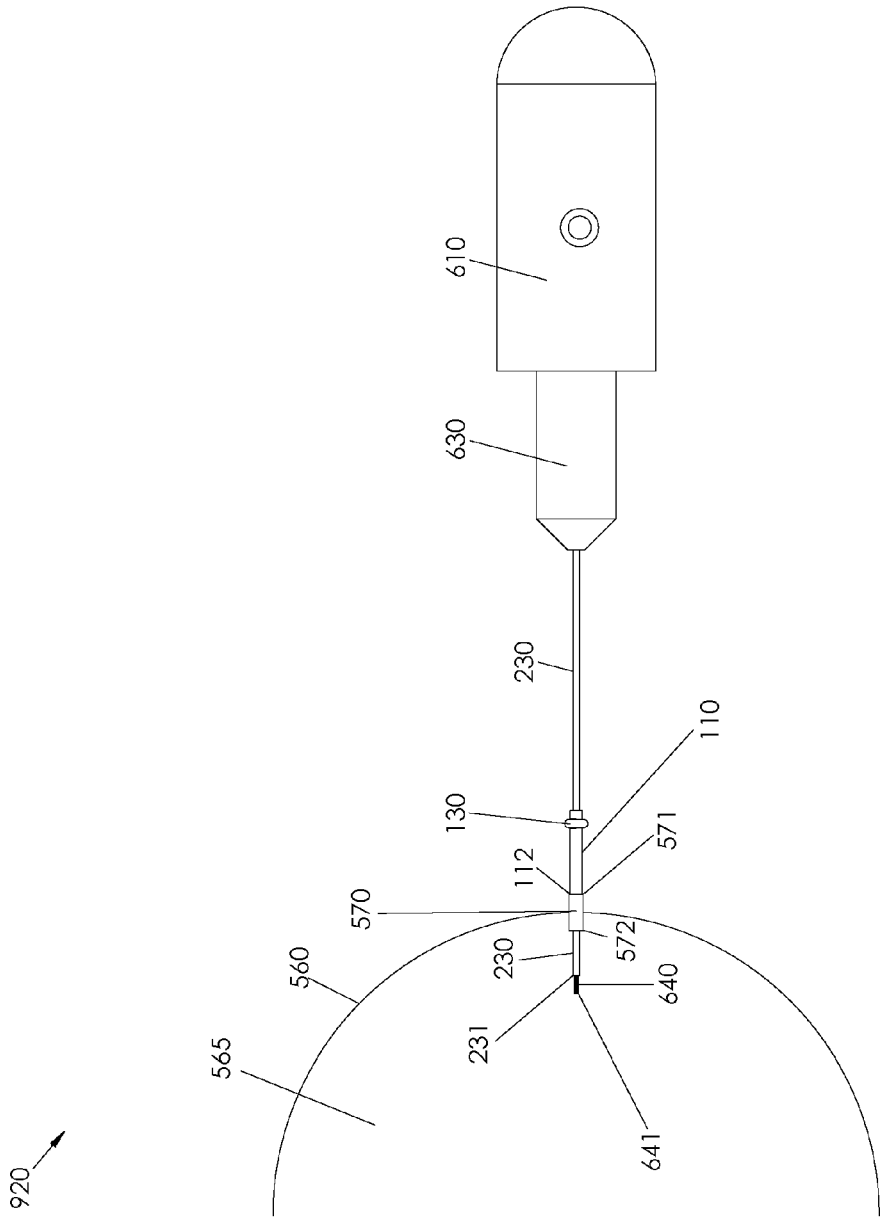


FIG. 9B



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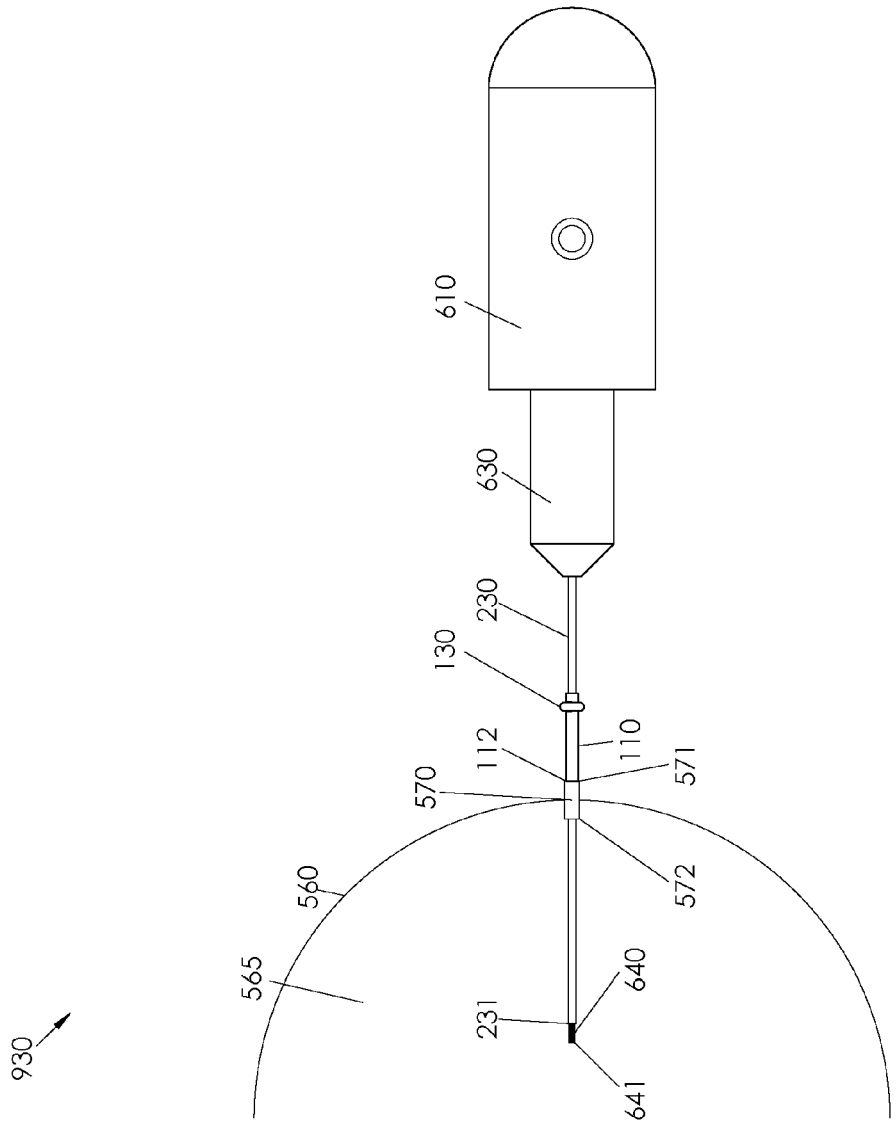

FIG. 9D

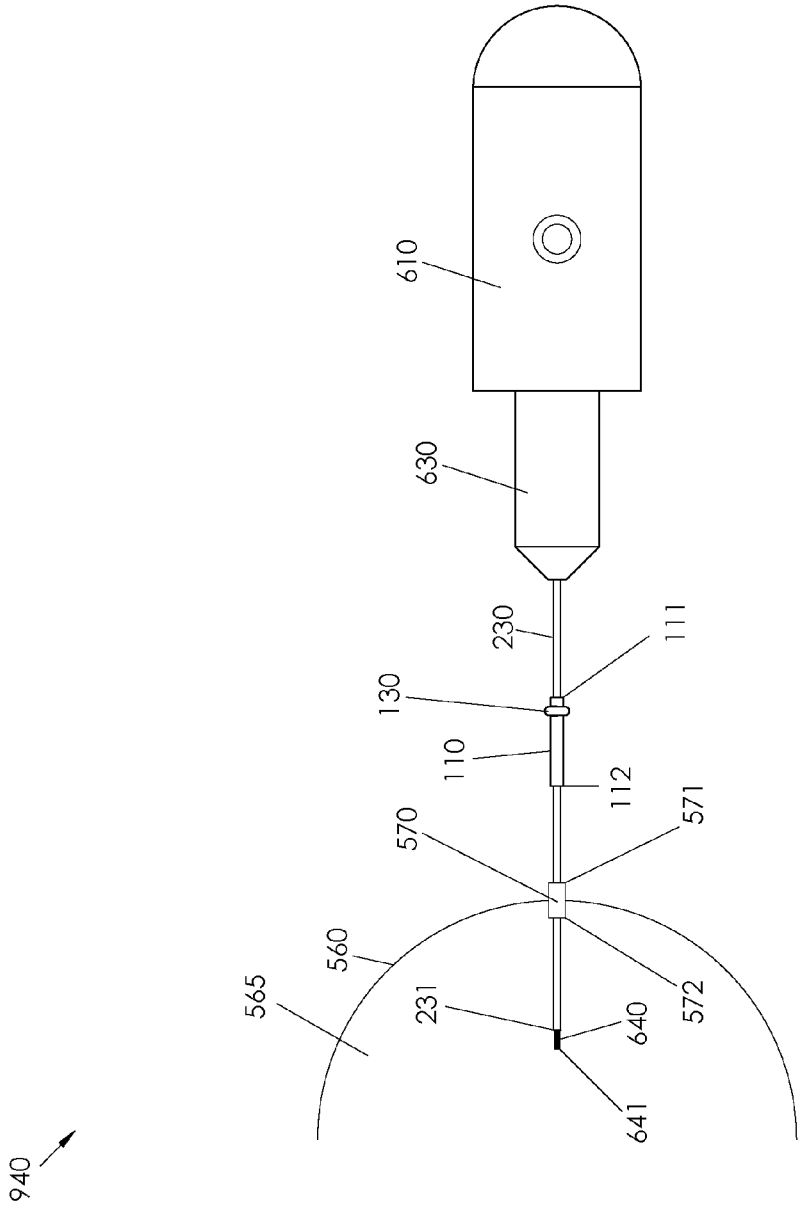

FIG. 9E

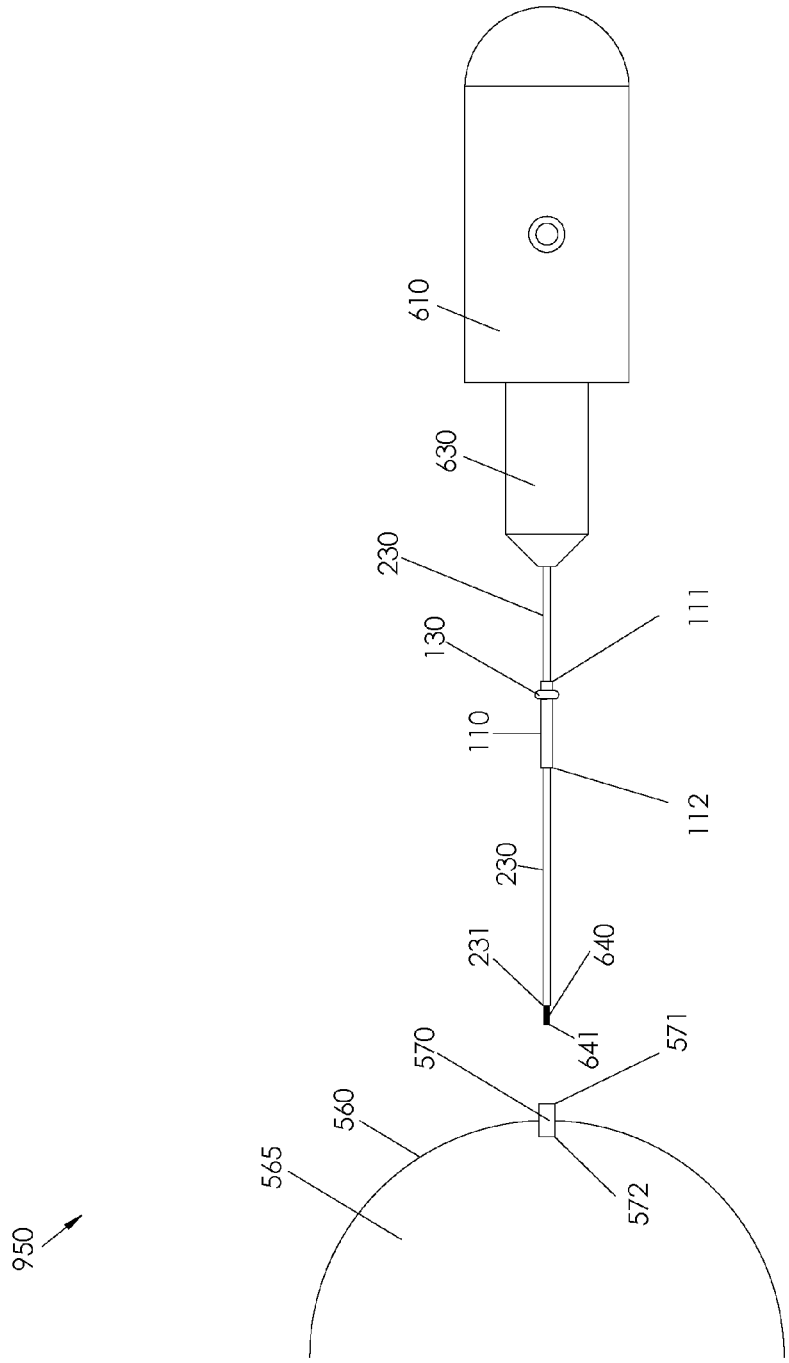
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FIG. 9F

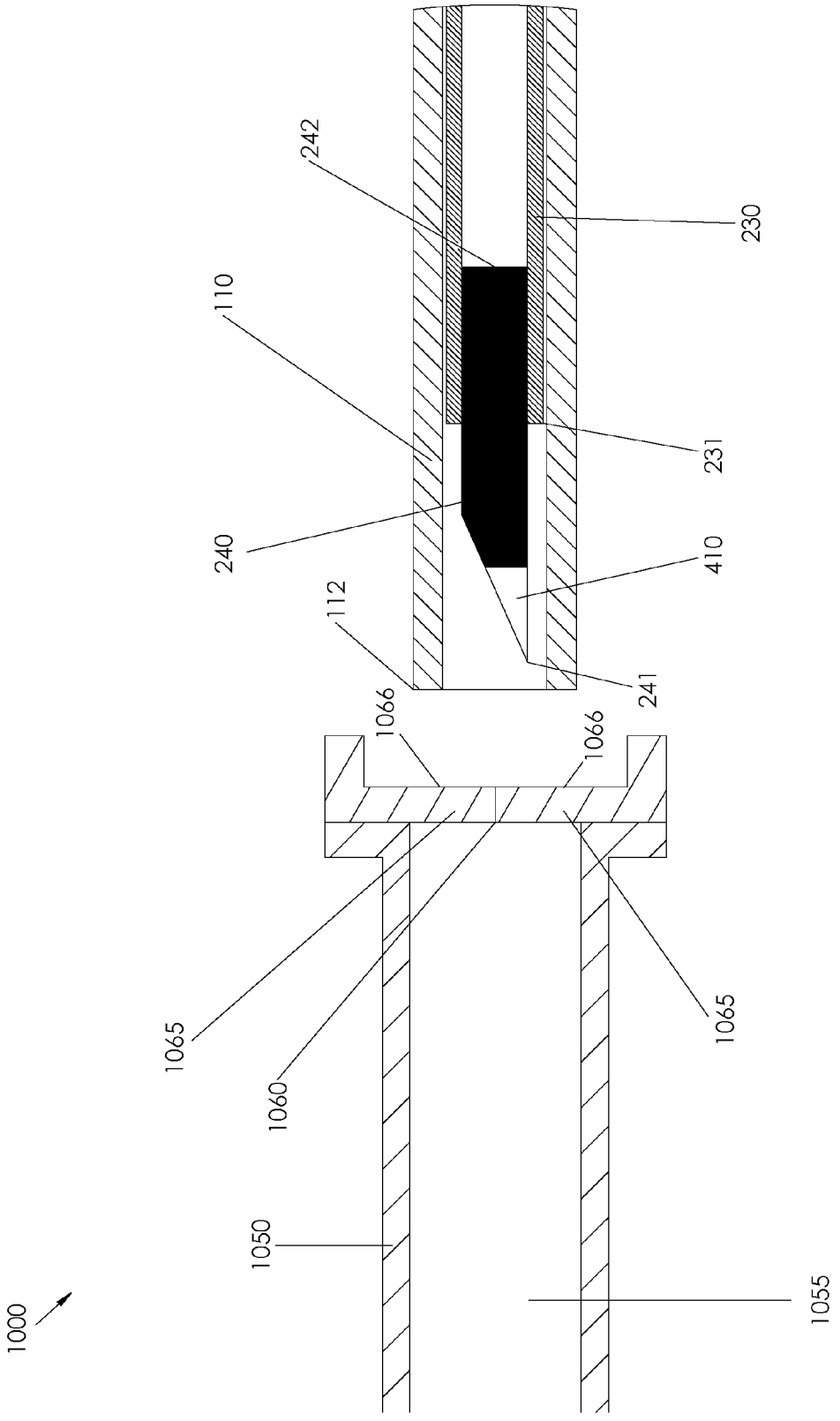
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FIG. 10A

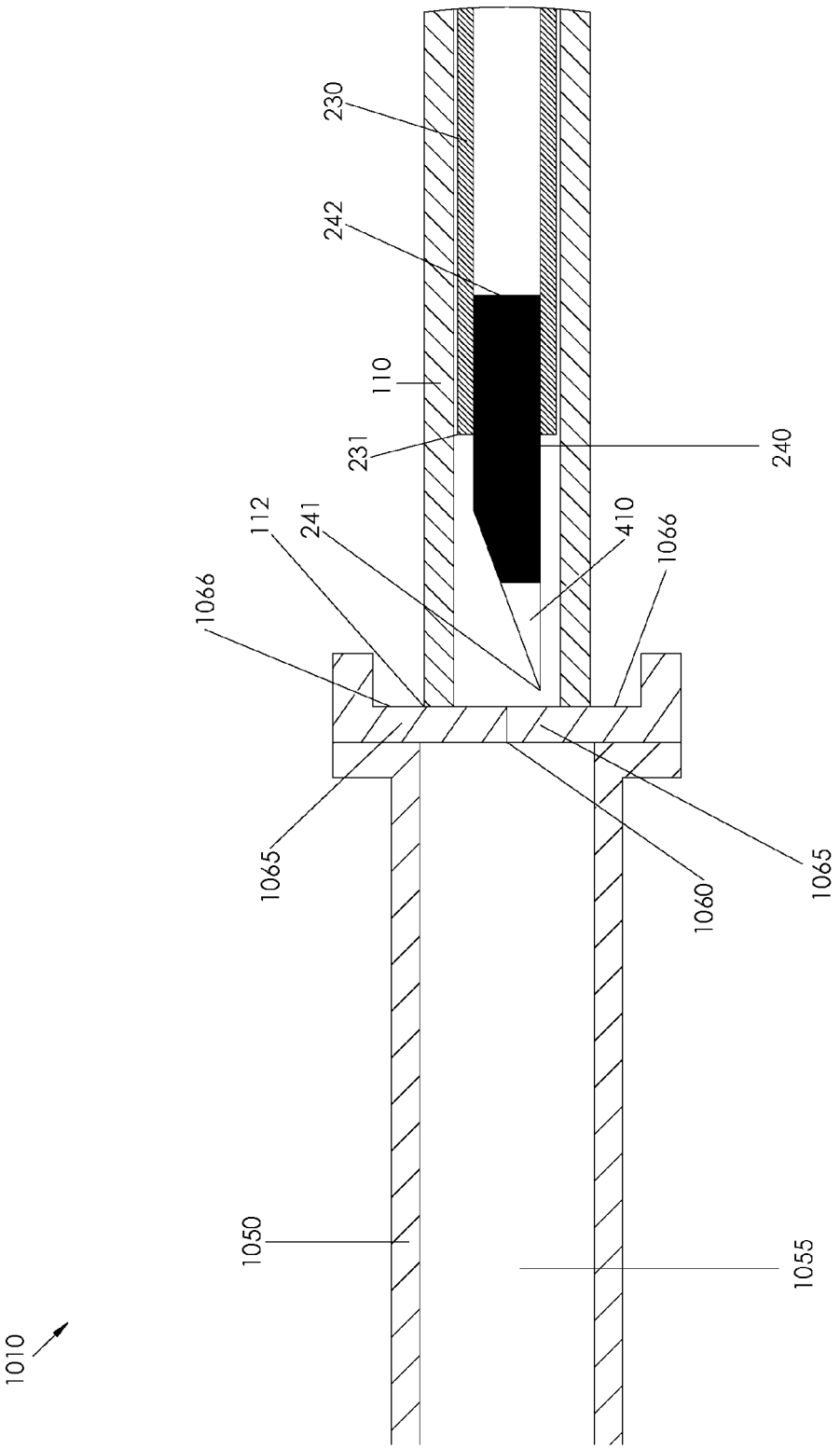
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FIG. 10B

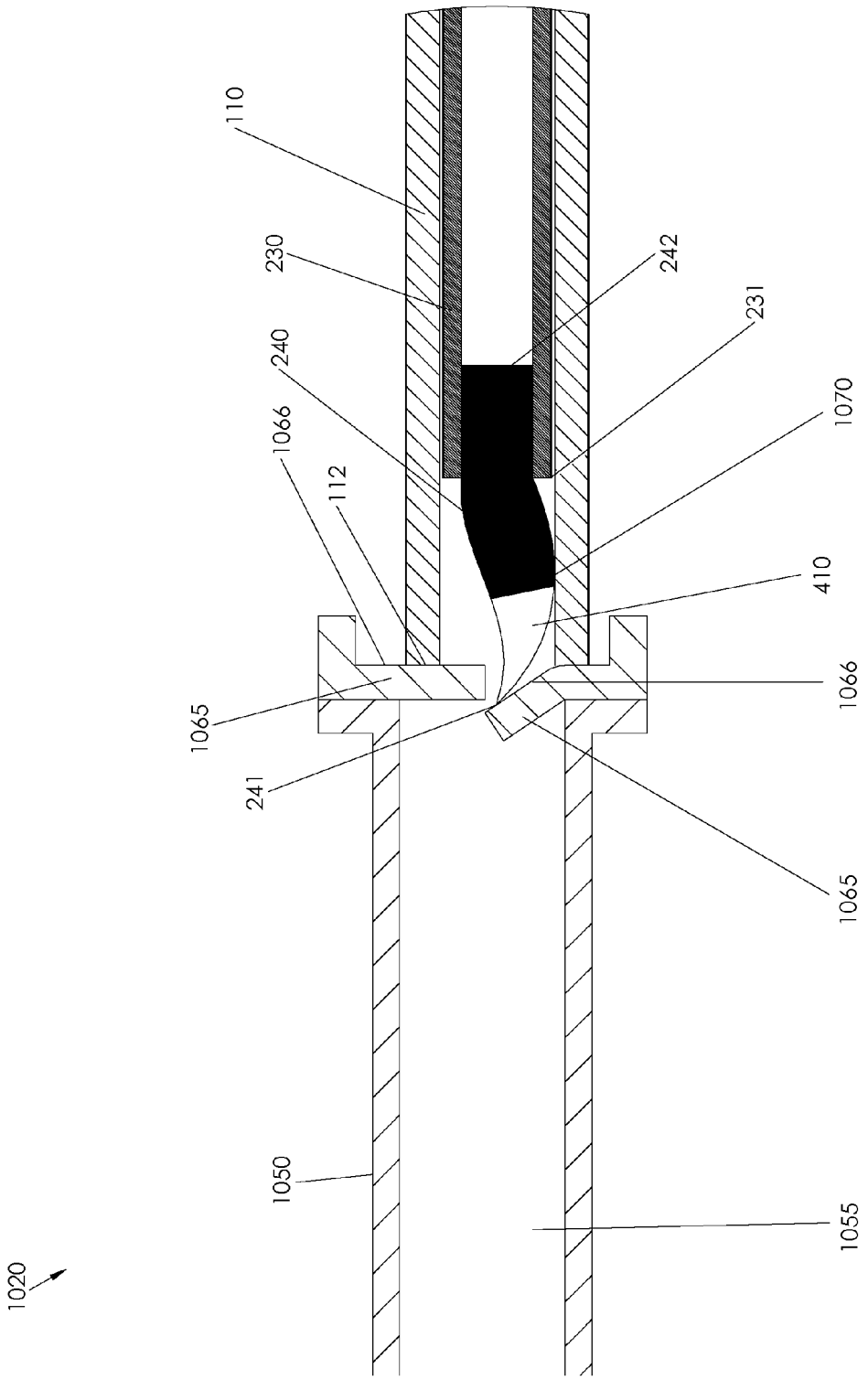
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FIG. 10C

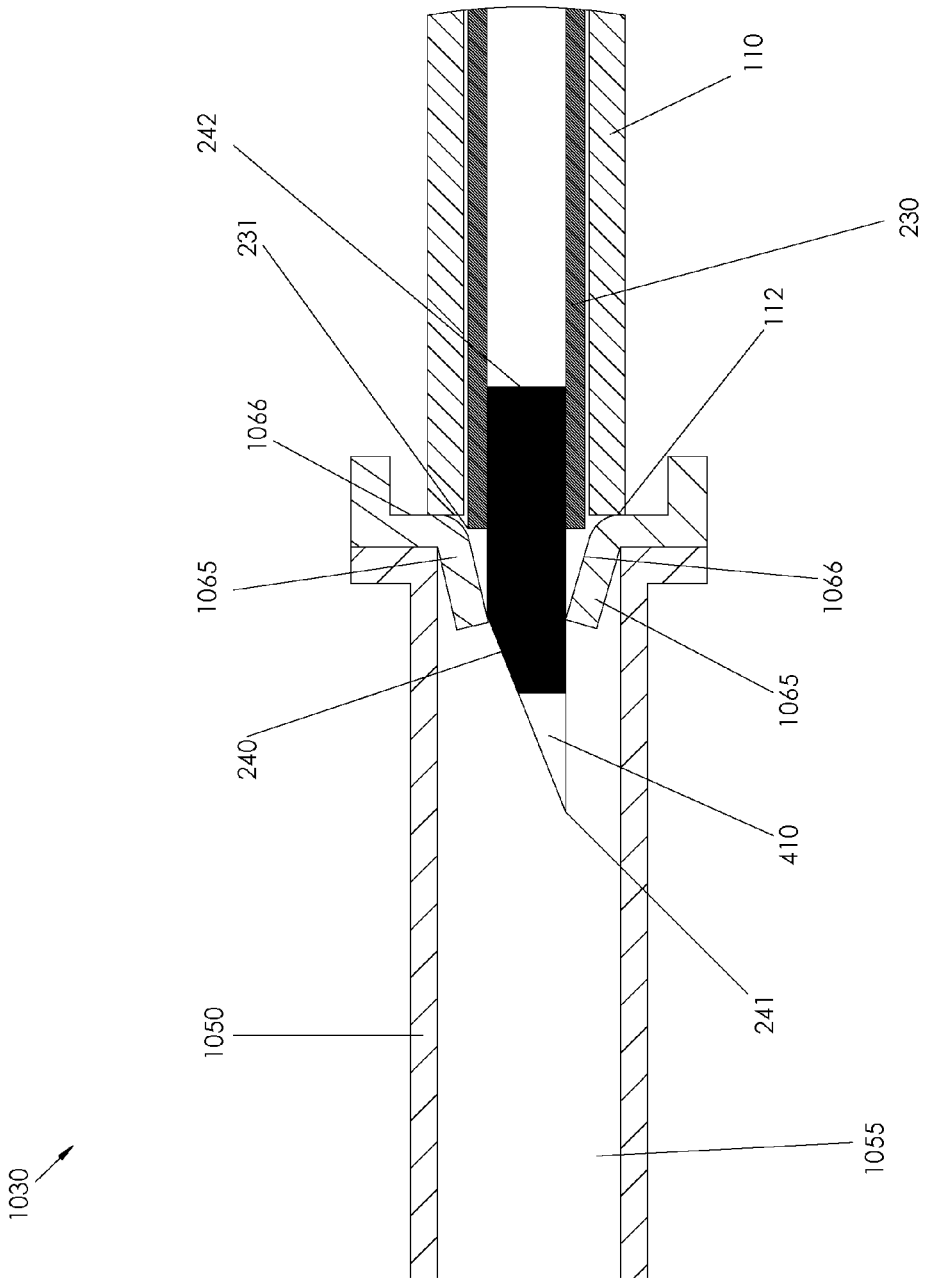
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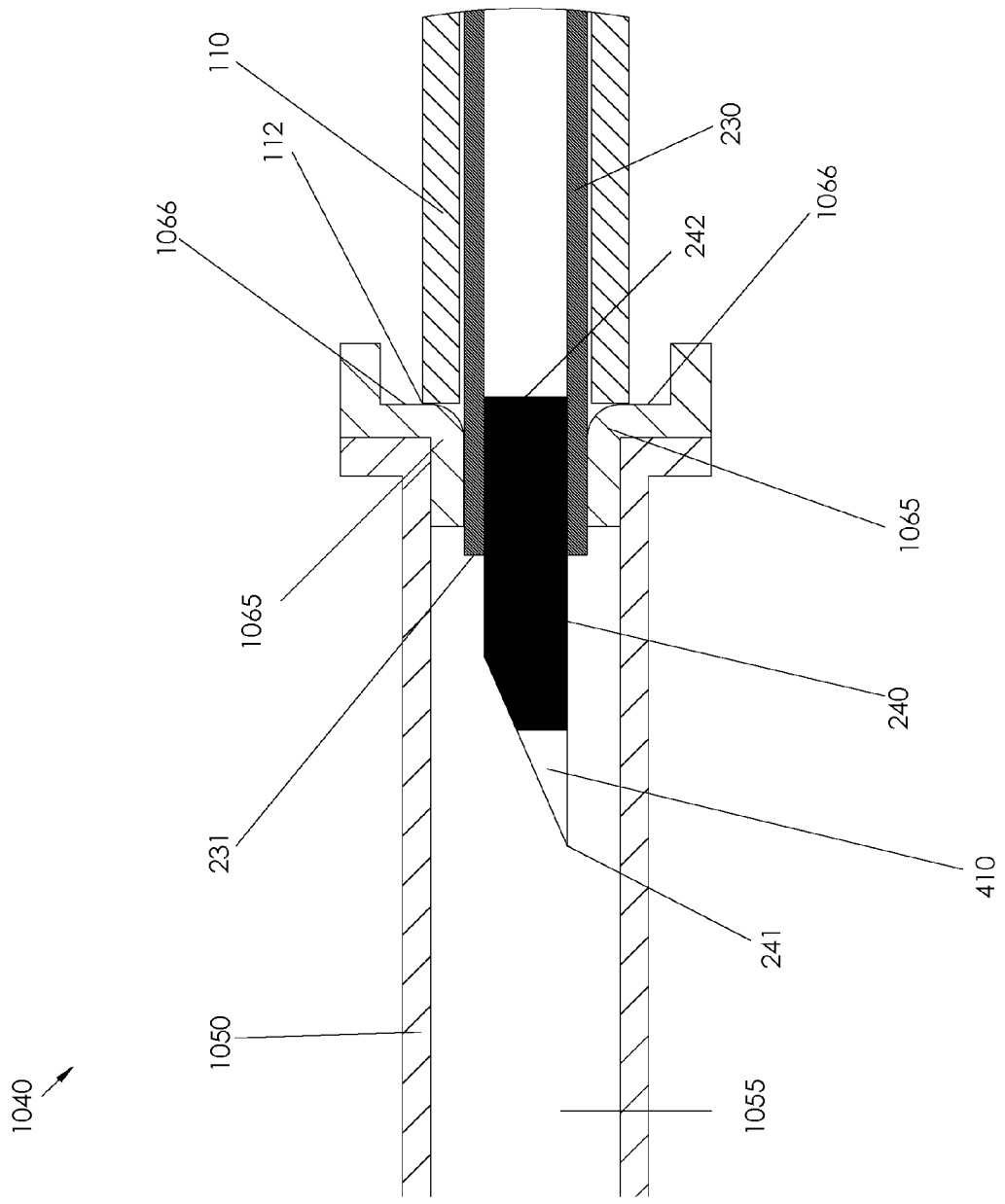
FIG. 10D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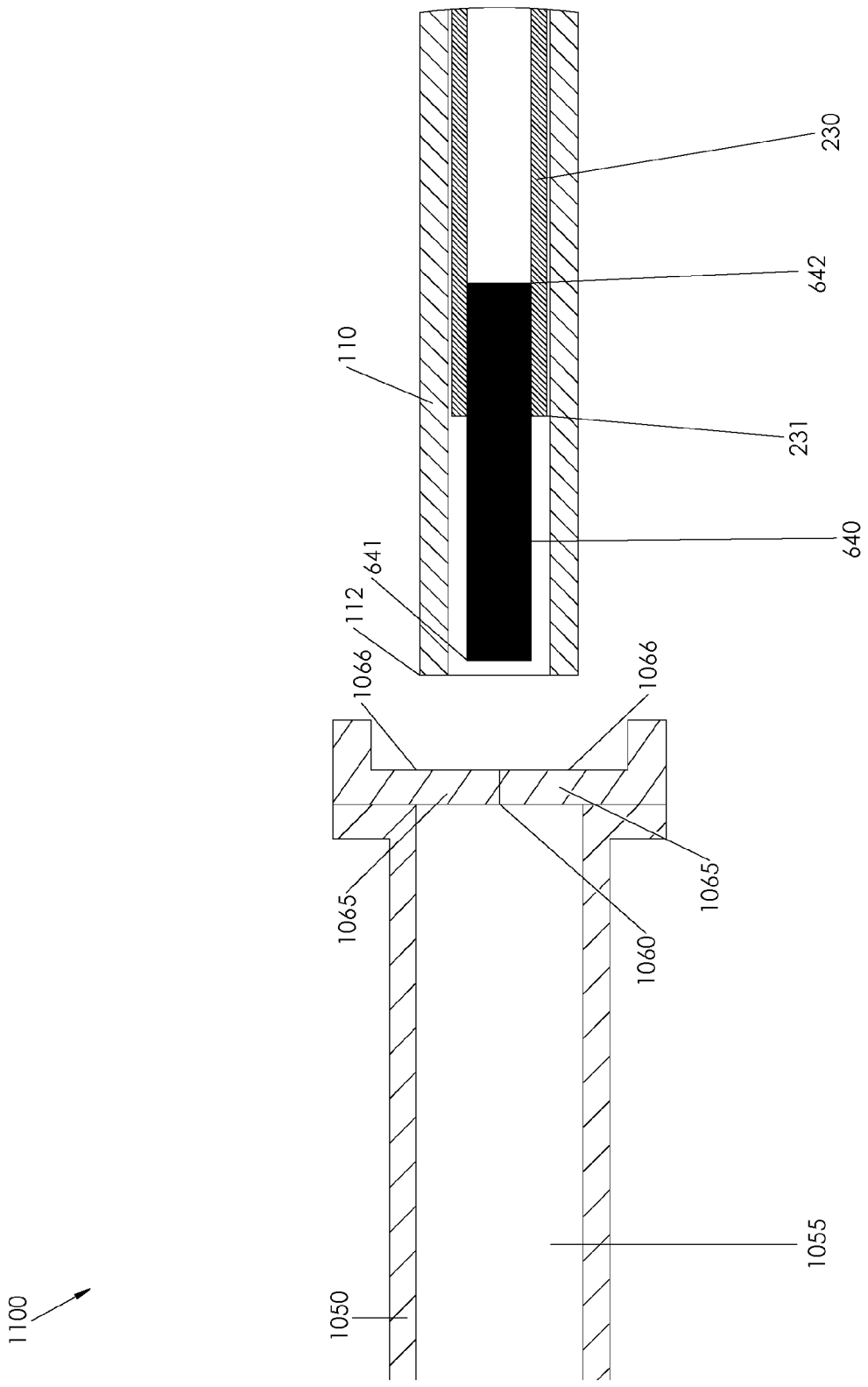
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FIG. 11A

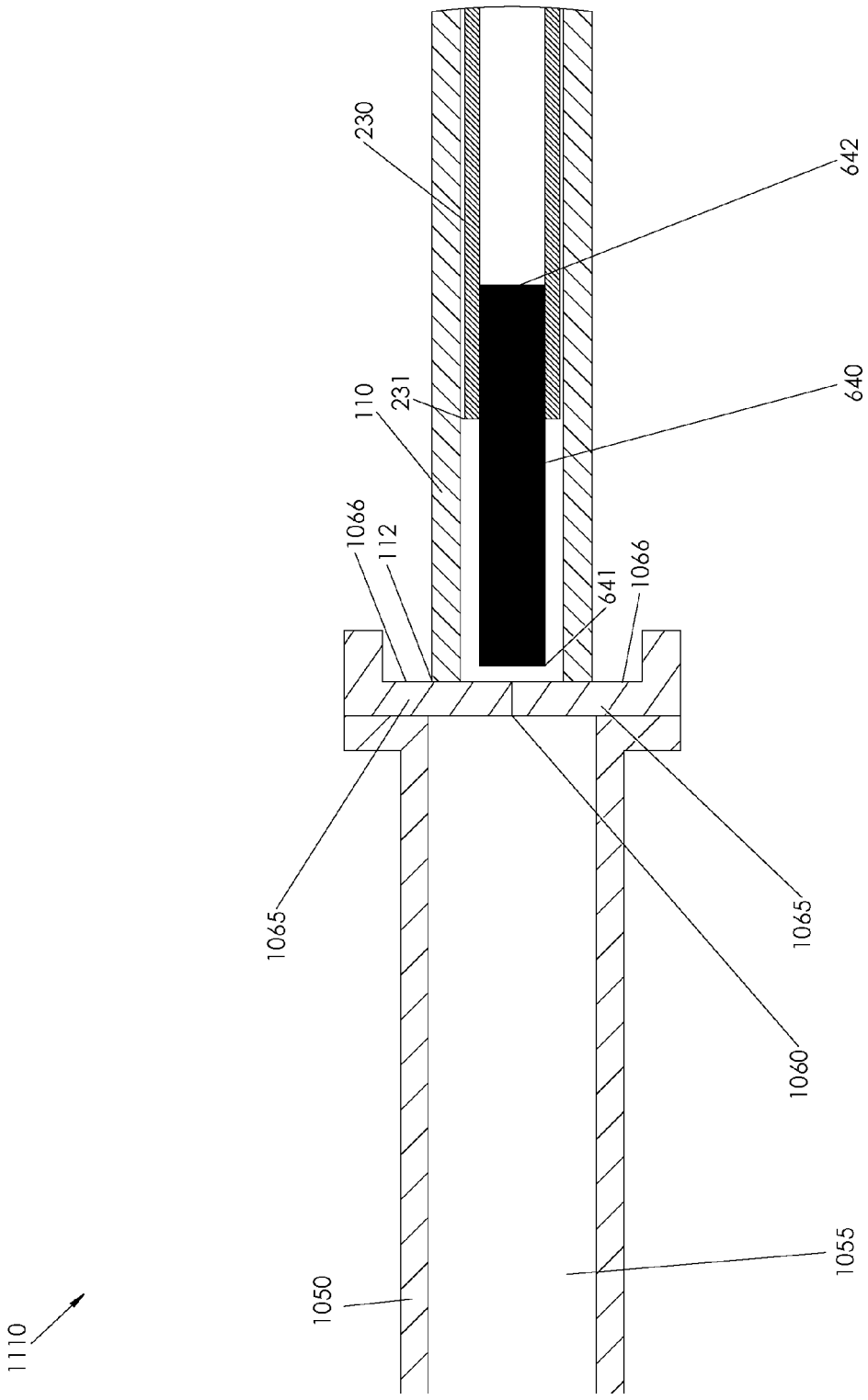
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FIG. 11B

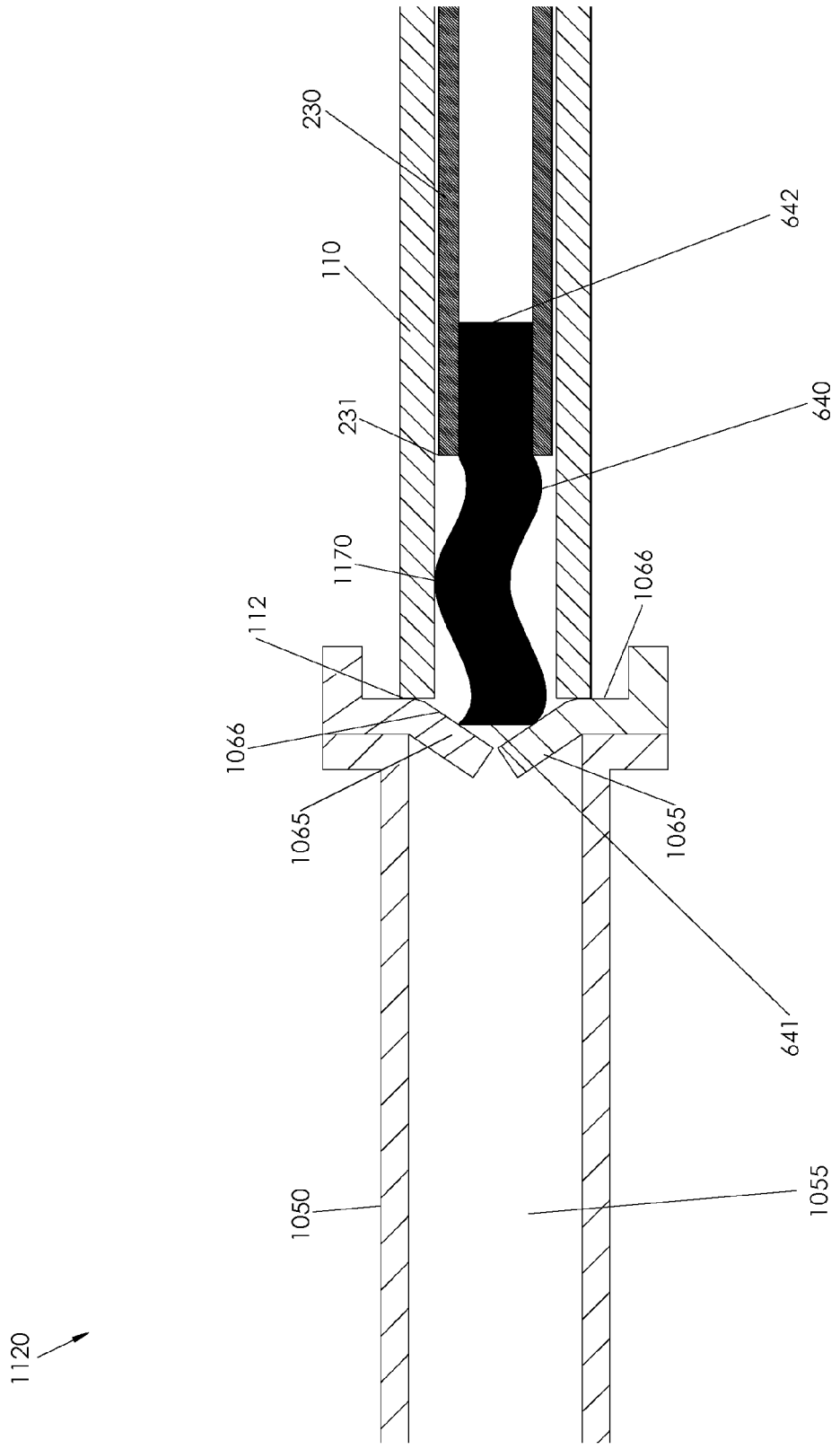
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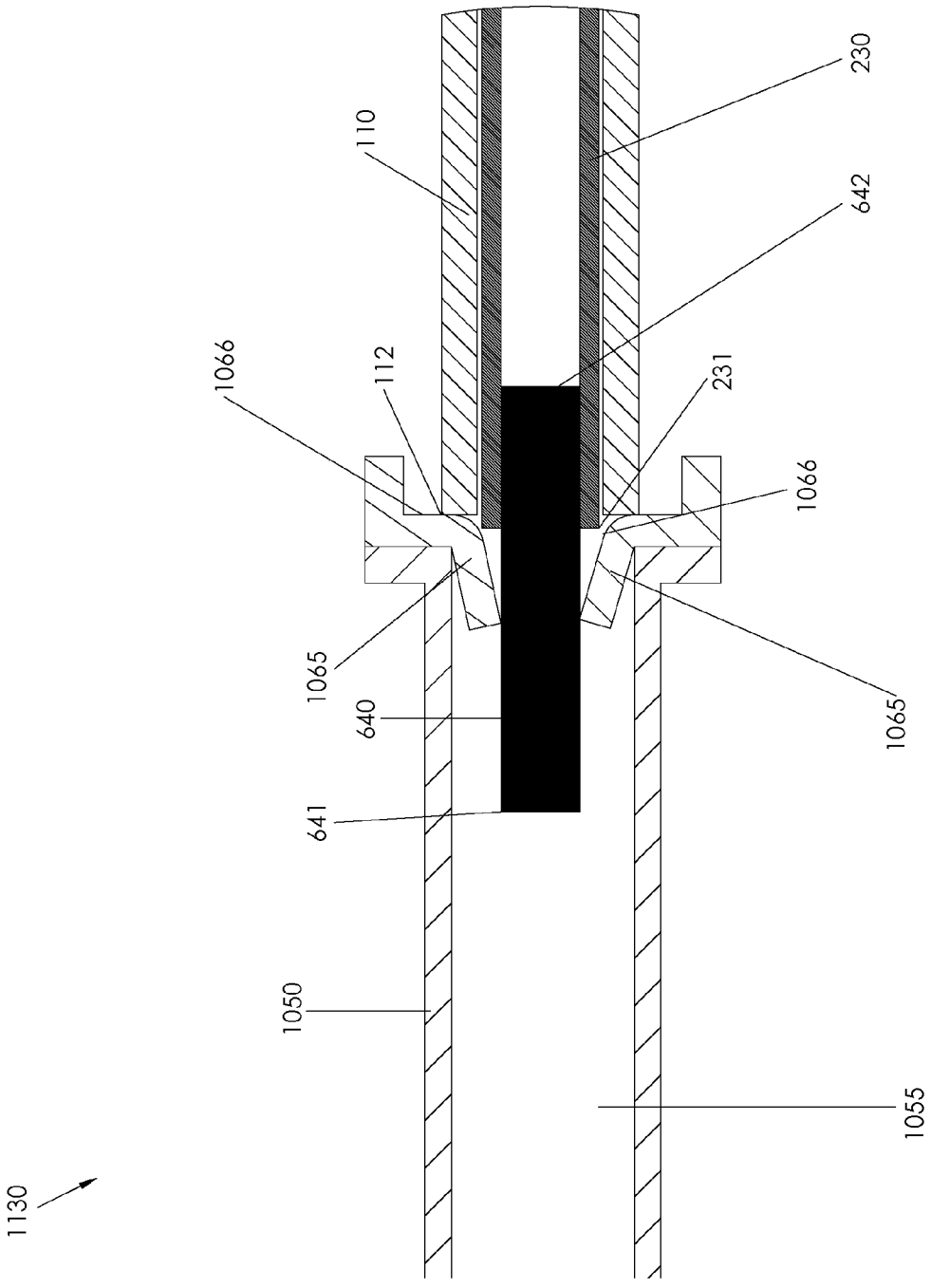
FIG. 11C



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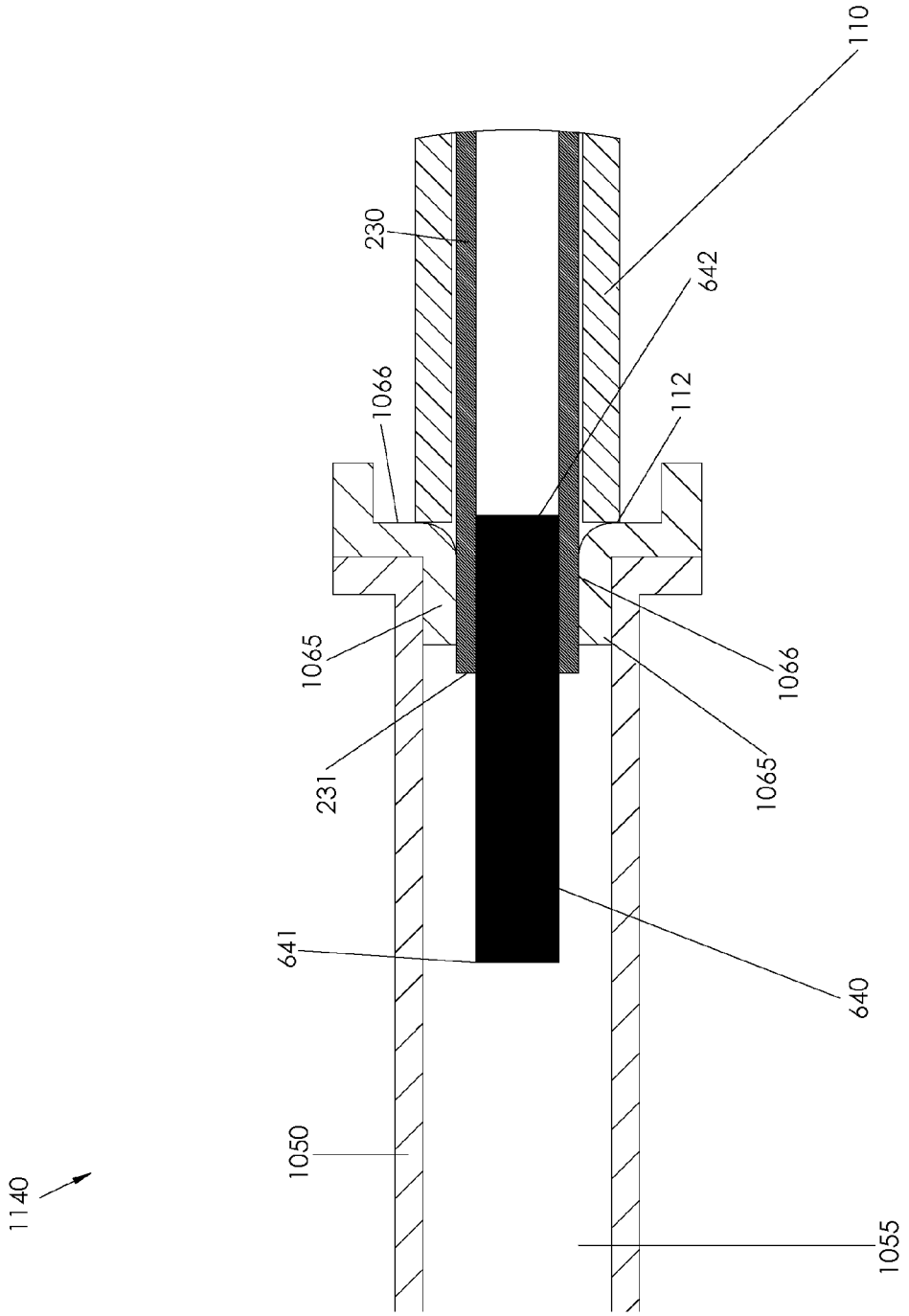

FIG.11E

CANNULA INGRESS SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

This Application claims the benefit of U.S. Provisional Application No. 62/062,678, Oct. 10, 2014.

FIELD OF THE INVENTION

The present disclosure relates to a medical device, and, more particularly, to a surgical instrument.

BACKGROUND OF THE INVENTION

Many ophthalmic surgical procedures in the posterior segment are performed through a cannula. For example, a surgeon may make an incision in the pars plana and then insert a cannula in the incision. The surgeon may then access the inner eye via the cannula. Ophthalmic surgical instruments having a soft, flexible tip may be difficult to insert into a cannula because the soft, flexible tip may deform as a surgeon attempts to ingress the cannula. For example, as a surgeon approaches a cannula to attempt a cannula ingress, a soft, flexible tip of an instrument must be precisely aligned with a cannula opening to prevent the soft, flexible tip from deforming.

BRIEF SUMMARY OF THE INVENTION

A cannula ingress system is presented. Illustratively, a cannula ingress system may comprise a tip stabilization mechanism having a tip stabilization mechanism distal end and a tip stabilization mechanism proximal end, a fixation mechanism, a hypodermic tube having a hypodermic tube distal end and a hypodermic tube proximal end, and a tip having a tip distal end and a tip proximal end. In one or more embodiments, the tip may be disposed within the hypodermic tube wherein the tip distal end extends from the hypodermic tube distal end. Illustratively, the fixation mechanism may be disposed within a fixation mechanism channel of the tip stabilization mechanism. In one or more embodiments, the tip stabilization mechanism may be disposed over the tip and the hypodermic tube distal end.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and further advantages of the present invention may be better understood by referring to the following description in conjunction with the accompanying drawings in which like reference numerals indicate identical or functionally similar elements:

FIGS. **1**A and **1**B are schematic diagrams illustrating a tip stabilization system assembly;

FIG. **2** is a schematic diagram illustrating an exploded view of an instrument assembly;

FIGS. **3**A and **3**B are schematic diagrams illustrating an assembled instrument;

FIG. **4** is a schematic diagram illustrating an exposed membrane removing tip;

FIGS. **5**A, **5**B, **5**C, **5**D, **5**E, and **5**F are schematic diagrams illustrating a portion of a surgical procedure;

FIG. **6** is a schematic diagram illustrating an exploded view of an irrigating and aspirating instrument assembly;

FIGS. **7**A and **7**B are schematic diagrams illustrating an assembled irrigating and aspirating instrument;

FIG. **8** is a schematic diagram illustrating an exposed irrigating and aspirating tip;

FIGS. **9**A, **9**B, **9**C, **9**D, **9**E, and **9**F are schematic diagrams illustrating a portion of a surgical procedure;

FIGS. **10**A, **10**B, **10**C, **10**D, and **10**E are schematic diagrams illustrating a portion of a surgical procedure;

FIGS. **11**A, **11**B, **11**C, **11**D, and **11**E are schematic diagrams illustrating a portion of a surgical procedure.

DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

FIGS. **1**A and **1**B are schematic diagrams illustrating a tip stabilization system assembly **100**. FIG. **1**A illustrates a side view of a tip stabilization system assembly **100**. In one or more embodiments, tip stabilization system assembly **100** may comprise a tip stabilization mechanism **110** and a fixation mechanism **130**. Illustratively, tip stabilization mechanism **110** may comprise a tip stabilization mechanism distal end **111**, a tip stabilization mechanism proximal end **112**, a tip stabilization mechanism outer diameter **113**, a tip stabilization mechanism inner diameter **114**, and a fixation mechanism channel **115**. In one or more embodiments, fixation mechanism channel **115** may have a width in a range of 0.01 to 0.05 inches, e.g., fixation mechanism channel **115** may have a width of 0.033 inches. Illustratively, fixation mechanism channel **115** may have a width of less than 0.01 inches or greater than 0.05 inches. In one or more embodiments, tip stabilization mechanism outer diameter **113** may be a distance in a range of 0.01 to 0.04 inches, e.g., tip stabilization mechanism outer diameter **113** may be a distance of 0.0226 inches. Illustratively, tip stabilization mechanism outer diameter **113** may be a distance of less than 0.01 inches or greater than 0.04 inches. In one or more embodiments, tip stabilization mechanism inner diameter **114** may be a distance in a range of 0.005 to 0.039 inches, e.g., tip stabilization mechanism inner diameter **114** may be a distance of 0.02 inches. Illustratively, tip stabilization mechanism inner diameter **114** may be a distance of less than 0.005 inches or greater than 0.039 inches. In one or more embodiments, tip stabilization mechanism **110** may have an overall length in a range of 0.2 to 0.4 inches, e.g., tip stabilization mechanism **110** may have an overall length of 0.3 inches. Illustratively, tip stabilization mechanism **110** may have an overall length of less than 0.2 inches or greater than 0.4 inches. In one or more embodiments, tip stabilization mechanism **110** may be manufactured from any suitable material, e.g., polymers, metals, metal alloys, etc., or from any combination of suitable materials. Illustratively, fixation mechanism **130** may comprise a fixation mechanism outer diameter **135** and a fixation mechanism inner diameter **136**. In one or more embodiments, fixation mechanism outer diameter **135** may be greater than tip stabilization mechanism outer diameter **113**, e.g., fixation mechanism outer diameter **135** may be a first distance and tip stabilization mechanism outer diameter **113** may be a second distance wherein the first distance is greater than the second distance. Illustratively, fixation mechanism outer diameter **135** may be less than tip stabilization mechanism outer diameter **113**, e.g., fixation mechanism outer diameter **135** may be a first distance and tip stabilization mechanism outer diameter **113** may be a second distance wherein the first distance is less than the second distance. In one or more embodiments, fixation mechanism outer diameter **135** may be equal to tip stabilization mechanism outer diameter **113**, e.g., fixation mechanism outer diameter **135** may be a first distance and tip stabilization mechanism outer diameter **113** may be a

second distance wherein the first distance is equal to the second distance. Illustratively, fixation mechanism outer diameter **135** may be greater than tip stabilization mechanism inner diameter **114**, e.g., fixation mechanism outer diameter **135** may be a first distance and tip stabilization mechanism inner diameter **114** may be a second distance wherein the first distance is greater than the second distance. In one or more embodiments, fixation mechanism outer diameter **135** may be less than tip stabilization mechanism inner diameter **114**, e.g., fixation mechanism outer diameter **135** may be a first distance and tip stabilization mechanism inner diameter **114** may be a second distance wherein the first distance is less than the second distance. Illustratively, fixation mechanism outer diameter **135** may be equal to tip stabilization mechanism inner diameter **114**, e.g., fixation mechanism outer diameter **135** may be a first distance and tip stabilization mechanism inner diameter **114** may be a second distance wherein the first distance is equal to the second distance. In one or more embodiments, fixation mechanism inner diameter **136** may be greater than tip stabilization mechanism outer diameter **113**, e.g., fixation mechanism inner diameter **136** may be a first distance and tip stabilization mechanism outer diameter **136** may be a second distance where in the first distance is greater than the second distance. Illustratively, fixation mechanism inner diameter **136** may be less than tip stabilization mechanism outer diameter **113**, e.g., fixation mechanism inner diameter **136** may be a first distance and tip stabilization mechanism outer diameter **136** may be a second distance where in the first distance is less than the second distance. In one or more embodiments, fixation mechanism inner diameter **136** may be equal to tip stabilization mechanism outer diameter **113**, e.g., fixation mechanism inner diameter **136** may be a first distance and tip stabilization mechanism outer diameter **136** may be a second distance where in the first distance is equal to the second distance. Illustratively, fixation mechanism inner diameter **136** may be greater than tip stabilization mechanism inner diameter **114**, e.g., fixation mechanism inner diameter **136** may be a first distance and tip stabilization mechanism inner diameter **114** may be a second distance wherein the first distance is greater than the second distance. In one or more embodiments, fixation mechanism inner diameter **136** may be less than tip stabilization mechanism inner diameter **114**, e.g., fixation mechanism inner diameter **136** may be a first distance and tip stabilization mechanism inner diameter **114** may be a second distance wherein the first distance is less than the second distance. Illustratively, fixation mechanism inner diameter **136** may be equal to tip stabilization mechanism inner diameter **114**, e.g., fixation mechanism inner diameter **136** may be a first distance and tip stabilization mechanism inner diameter **114** may be a second distance wherein the first distance is equal to the second distance. In one or more embodiments, fixation mechanism **130** may be manufactured from any suitable material, e.g., polymers, metals, metal alloys, etc., or from any combination of suitable materials. FIG. **1**B illustrates a cross-sectional view of a tip stabilization system assembly **100**. In one or more embodiments, fixation mechanism **130** may have a cross-sectional radius in a range of 0.005 to 0.03 inches, e.g., fixation mechanism **130** may have a cross-sectional radius of 0.015 inches. Illustratively, fixation mechanism **130** may have a cross-sectional radius of less than 0.005 inches or greater than 0.03 inches. In one or more embodiments, tip stabilization mechanism **110** may comprise an inner bore **120** having an inner bore distal end **121** and an inner bore proximal end **122**. Illustratively, fixation mechanism **130** and tip stabilization mechanism **110** may be manufactured as a single component, e.g., fixation mechanism **130** may comprise a feature of tip stabilization mechanism **110**. In one or more embodiments, tip stabilization mechanism **110** may comprise a tube and fixation mechanism **130** may comprise a discontinuity in inner bore **120**, e.g., tube fixation mechanism **130** may comprise a portion of inner bore **120** having an inner diameter less than tip stabilization mechanism inner diameter **114**.

FIG. **2** is a schematic diagram illustrating an exploded view of an instrument assembly **200**. In one or more embodiments, an instrument assembly **200** may comprise a tip stabilization mechanism **110**, a fixation mechanism **130**, a handle **210**, an identification ring **220**, a hypodermic tube **230**, and a membrane removing tip **240**. Illustratively, handle **210** may comprise a handle distal end **211**, a handle proximal end **212**, an identification ring channel **215**, a handle grip **216**, and a hypodermic tube interface **217**. In one or more embodiments, handle **210** may be manufactured from any suitable material, e.g., polymers, metals, metal alloys, etc., or from any combination of suitable materials. Illustratively, hypodermic tube **230** may comprise a hypodermic tube distal end **231** and a hypodermic tube proximal end **232**. In one or more embodiments, hypodermic tube **230** may be manufactured at dimensions configured for performing microsurgical procedures, e.g., hypodermic tube **230** may be manufactured at dimensions configured for performing ophthalmic surgical procedures. Illustratively, hypodermic tube **230** may be 20 gauge, 23 gauge, 25 gauge, 27 gauge, etc. In one or more embodiments, hypodermic tube **230** may be manufactured from any suitable material, e.g., polymers, metals, metal alloys, etc., or from any combination of suitable materials. Illustratively, membrane removing tip **240** may comprise a membrane removing tip distal end **241** and a membrane removing tip proximal end **242**. In one or more embodiments, membrane removing tip **240** may be manufactured from any suitable material, e.g., polymers, metals, metal alloys, etc., or from any combination of suitable materials. Illustratively, membrane removing tip **240** may be manufactured from silicone, e.g., biocompatible silicone.

FIGS. **3**A and **3**B are schematic diagrams illustrating an assembled instrument **300**. FIG. **3**A illustrates a side view of an assembled instrument **300**. In one or more embodiments, fixation mechanism **130** may be disposed over a portion of tip stabilization mechanism **110**, e.g., fixation mechanism **130** may be disposed between tip stabilization mechanism distal end **111** and tip stabilization mechanism proximal end **112**. Illustratively, a portion of fixation mechanism **130** may be disposed within a portion of tip stabilization mechanism **110**, e.g., a portion of fixation mechanism **130** may be disposed within fixation mechanism channel **115**. In one or more embodiments, a portion of fixation mechanism **130** may be disposed within inner bore **120**. Illustratively, a portion of fixation mechanism **130** may be fixed to a portion of tip stabilization mechanism **110**, e.g., fixation mechanism inner diameter **136** may be fixed to a portion of tip stabilization mechanism **110**. In one or more embodiments, a portion of fixation mechanism **130** may be fixed to a portion of tip stabilization mechanism **110** by a force of friction or by any suitable fixation means, e.g., a portion of fixation mechanism **130** may be fixed to a portion of tip stabilization mechanism **110** by an adhesive, a weld, etc.

Illustratively, tip stabilization mechanism **110** may be disposed over a portion of hypodermic tube **230**, e.g., tip stabilization mechanism distal end **111** may be disposed over hypodermic tube distal end **231**. In one or more embodiments, a portion of hypodermic tube **230** may be disposed

within inner bore **120**, e.g., hypodermic tube distal end **231** may be disposed within inner bore **120**. Illustratively, hypodermic tube **230** may be disposed within fixation mechanism **130**, e.g., hypodermic tube **230** may be disposed within fixation mechanism inner diameter **136**. In one or more embodiments, hypodermic tube **230** may not be disposed within fixation mechanism **130**, e.g., a portion of hypodermic tube **230** may be disposed adjacent to a portion of fixation mechanism **130**. Illustratively, fixation mechanism **130** may be configured to temporarily fix tip stabilization mechanism **110** in a position relative to hypodermic tube **230**, e.g., a static friction force between fixation mechanism **130** and hypodermic tube **230** may be configured to temporarily fix tip stabilization mechanism **110** in a position relative to hypodermic tube **230**. In one or more embodiments, a contact between a portion of fixation mechanism **130** and a portion of hypodermic tube **230** may be configured to temporarily fix tip stabilization mechanism **110** in a position relative to hypodermic tube **230**. Illustratively, fixation mechanism **130** may be fixed to both tip stabilization mechanism **110** and hypodermic tube **230** wherein a static friction force between fixation mechanism **130** and hypodermic tube **230** may be configured to temporarily fix tip stabilization mechanism **110** in a position relative to hypodermic tube **230**.

Illustratively, a portion of membrane removing tip **240** may be disposed within hypodermic tube **230**, e.g., membrane removing tip proximal end **242** may be disposed within hypodermic tube distal end **231**. In one or more embodiments, a portion of membrane removing tip **240** may be disposed within hypodermic tube **230** wherein a portion of membrane removing tip **240** extends from a portion of hypodermic tube **230**, e.g., a portion of membrane removing tip **240** may be disposed within hypodermic tube **230** wherein membrane removing tip distal end **241** extends from hypodermic tube distal end **231**. Illustratively, a portion of membrane removing tip **240** may be fixed within hypodermic tube **230**, e.g., membrane removing tip proximal end **242** may be fixed within hypodermic tube **230**. In one or more embodiments, a portion of membrane removing tip **240** may be fixed within hypodermic tube **230** by an adhesive or any suitable fixation means, e.g., a portion of membrane removing tip **240** may be fixed within hypodermic tube **230** by a friction fit, a weld, etc.

Illustratively, identification ring **220** may be disposed over a portion of handle **210**, e.g., identification ring **220** may be disposed within identification ring channel **215**. In one or more embodiments, identification ring **220** may be fixed to a portion of handle **210**, e.g., identification ring **220** may be fixed within identification ring channel **215** by an adhesive, a force of friction, a weld, or any suitable fixation means. Illustratively, identification ring **220** may be configured to indicate one or more properties of assembled instrument **300** to a surgeon, a nurse, or a surgical technician, e.g., identification ring **220** may comprise a color or a marking configured to visually indicate a minimum cannula gauge size that hypodermic tube **230** may ingress to perform a surgical procedure. In one or more embodiments, identification ring **220** may be manufactured from a shape memory material, e.g., Nitinol. Illustratively, identification ring **220** may be manufactured from an elastomer material, e.g., a biocompatible elastomer material. In one or more embodiments, identification ring **220** may be manufactured from any suitable material, e.g., polymers, metals, metal alloys, etc., or from any combination of suitable materials.

FIG. **3**B illustrates a cross-sectional view of an assembled instrument **300**. In one or more embodiments, an assembled instrument **300** may comprise an inner chamber proximal taper **310**, an inner chamber **320**, an inner chamber distal taper **330**, and a hypodermic tube housing **340**. Illustratively, a portion of hypodermic tube **230** may be disposed within a portion of handle **210**, e.g., a portion of hypodermic tube **230** may be disposed within a portion of handle **210** wherein the portion of hypodermic tube **230** may be adjacent to hypodermic tube interface **117**. In one or more embodiments, a portion of hypodermic tube **230** may be disposed within hypodermic tube housing **340**, e.g., hypodermic tube proximal end **232** may be disposed within hypodermic tube housing **340**. In one or more embodiments, a portion of hypodermic tube **230** may be fixed within a portion of handle **210**, e.g., a portion of hypodermic tube **230** may be fixed within hypodermic tube housing **340**. Illustratively, a portion of hypodermic tube **230** may be fixed within hypodermic tube housing by an interference fit, an adhesive, a weld, etc. In one or more embodiments, a portion of hypodermic tube **230** may be fixed within a portion of handle **210** wherein hypodermic tube distal end **231** extends out from hypodermic tube housing **340**.

Illustratively, membrane removing tip **240** may be disposed within hypodermic tube **230** and tip stabilization mechanism **110**, e.g., membrane removing tip distal end **241** may be disposed between tip stabilization mechanism distal end **111** and tip stabilization mechanism proximal end **112**. In one or more embodiments, membrane removing tip **240** may be disposed within hypodermic tube **230** and tip stabilization mechanism **110** wherein membrane removing tip proximal end **242** may be disposed between hypodermic tube distal end **231** and hypodermic tube proximal end **232**. Illustratively, hypodermic tube **230** may be disposed within tip stabilization mechanism **110** wherein hypodermic tube distal end **231** is disposed between tip stabilization mechanism distal end **111** and tip stabilization mechanism proximal end **112**.

FIG. **4** is a schematic diagram illustrating an exposed membrane removing tip **400**. In one or more embodiments, membrane removing tip **240** may be colored black, e.g., to enhance visualization of membrane removing tip **240**. For example, membrane removing tip **240** may be manufactured from black silicone to enhance visualization of membrane removing tip **240**. Illustratively, membrane removing tip **240** may be colored any color not contained within Johannes Itten's color wheel to enhance visualization of membrane removing tip **240**, e.g., membrane removing tip **240** may be colored black or grey to enhance visualization of membrane removing tip **240**. In one or more embodiments, an exposed membrane removing tip **400** may comprise an abrasive surface **410** and a membrane removing tip taper angle **420**. Illustratively, membrane removing tip taper angle **420** may be an angle in a range of 10.0 to 60.0 degrees, e.g., membrane removing taper angle **420** may be an angle of 25.0 degrees. In one or more embodiments, membrane removing taper angle **420** may be an angle of less than 10.0 degrees or greater than 60.0 degrees.

In one or more embodiments, abrasive surface **410** may be configured to grasp a portion of a membrane, e.g., abrasive surface **410** may be configured to grasp a portion of an internal limiting membrane. Illustratively, a surgeon may maneuver a portion of abrasive surface **410** across a portion of a membrane, e.g., to raise a portion of the membrane. In one or more embodiments, abrasive surface **410** may be configured to grasp a portion of a first tissue disposed over a second tissue without damaging the second tissue. Illustratively, abrasive surface **410** may be configured to grasp a first tissue having a convex surface geometry disposed over

a second tissue having a convex surface geometry without damaging the second tissue. In one or more embodiments, abrasive surface **410** may be manufactured by fixing particles, e.g., inert particles, to a portion of membrane removing tip **240**. Illustratively, particles may be fixed to a portion of membrane removing tip **240**, e.g., by an adhesive or any suitable fixation means. In one or more embodiments, particles may be fixed to a portion of membrane removing tip **240** by a biocompatible high temperature epoxy. Illustratively, particles may be fixed to a portion of membrane removing tip **240** by a biocompatible spectrally transparent epoxy. In one or more embodiments, a portion of membrane removing tip **240** may be coated by a material configured to facilitate adhesion of particles. Illustratively, a portion of membrane removing tip **240** may be coated by a material, e.g., silicon, and then particles may be fixed to the material, e.g., by an adhesive or any suitable fixation means. In one or more embodiments, abrasive surface **410** may be manufactured by fixing particles to a portion of membrane removing tip **240**, e.g., particles may comprise diamond particles, sapphire particles, ruby particles, emerald particles, etc. Illustratively, abrasive surface **410** may be manufactured by fixing biocompatible particles to a portion of membrane removing tip **240**. In one or more embodiments, abrasive surface **410** may be manufactured by fixing particles having particle diameters in a range of 5.0 to 25.0 micrometers to a portion of membrane removing tip **240**, e.g., abrasive surface **410** may be manufactured by fixing particles having particle diameters of 15.0 micrometers to a portion of membrane removing tip **240**. Illustratively, abrasive surface **410** may be manufactured by fixing particles having particle diameters less than 5.0 micrometers or greater than 25.0 micrometers to a portion of membrane removing tip **240**. In one or more embodiments, membrane removing tip **240** may be colored black, e.g., to enhance visualization of abrasive surface **410**. For example, membrane removing tip **240** may be manufactured from black silicone to enhance visualization of abrasive surface **410**. Illustratively, membrane removing tip **240** may be colored any color not contained within Johannes Itten's color wheel to enhance visualization of abrasive surface **410**, e.g., membrane removing tip **240** may be colored black or grey to enhance visualization of abrasive surface **410**.

In one or more embodiments, abrasive surface **410** may be manufactured by modifying membrane removing tip **240**, e.g., by an electric discharge machine. Illustratively, abrasive surface **410** may be manufactured by actuating a portion of membrane removing tip **240** relative to a wire of an electric discharge machine, e.g., to form a plurality of micropillars. In one or more embodiments, abrasive surface **410** may be manufactured by actuating a wire of an electric discharge machine relative to a portion of membrane removing tip **240**, e.g., to form a plurality of micropillars. Illustratively, membrane removing tip **240** may be modified, e.g., by an electric discharge machine, wherein one or more portions of membrane removing tip **240** comprise a plurality of micropillars. Illustratively, abrasive surface **410** may be manufactured by modifying membrane removing tip **240**, e.g., by laser ablation. In one or more embodiments, abrasive surface **410** may be manufactured by modifying membrane removing tip **240**, e.g., by femtosecond laser ablation. Illustratively, abrasive surface **410** may be manufactured by applying laser energy to a portion of membrane removing tip **240** wherein the laser energy is applied in geometric patterns configured to fabricate micropillars on a surface of membrane removing tip **240**, e.g., the laser energy may be applied in concentric circles, polygons, etc. In one or more embodiments, abrasive surface **410** may be manufactured by applying laser energy to a portion of membrane removing tip **240** wherein the laser energy is applied repeatedly in geometric patterns configured to fabricate micropillars on a surface of membrane removing tip **240**, e.g., the laser energy may be repeatedly applied in concentric circles, polygons, etc. Illustratively, membrane removing tip **240** may be modified, e.g., by laser ablation, wherein one or more portions of membrane removing tip **240** comprise a plurality of micropillars. In one or more embodiments, membrane removing tip **240** may be modified wherein one or more portions of membrane removing tip **240** comprise a plurality of micropillars and then membrane removing tip **240** may be modified to manufacture membrane removing tip **240**. Illustratively, one or more portions of membrane removing tip **240** may comprise a plurality of micropillars. In one or more embodiments, membrane removing tip **240** may be modified, e.g., by an electric discharge machine, to manufacture membrane removing tip **240** and then membrane removing tip **240** may be modified, e.g., by laser ablation, wherein one or more portions of membrane removing tip **240** comprise a plurality of micropillars.

Illustratively, abrasive surface **410** may be manufactured by modifying membrane removing tip **240**, e.g., by deep reactive-ion etching. In one or more embodiments, abrasive surface **410** may be manufactured by modifying membrane removing tip **240**, e.g., by the Bosch process of time-multiplexed etching. Illustratively, abrasive surface **410** may be manufactured by exposing a portion of membrane removing tip **240** to repeated cycles of isotropic plasma etching followed by deposition of a chemically inert passivation layer to fabricate a plurality of micropillars on a surface of membrane removing tip **240**. In one or more embodiments, abrasive surface **410** may be manufactured by fabricating a plurality of micropillars on a substrate and then fixing the substrate to a portion of membrane removing tip **240**. Illustratively, membrane removing tip **240** may be modified, e.g., by deep reactive-ion etching, wherein one or more portions of membrane removing tip **240** comprise a plurality of micropillars. In one or more embodiments, membrane removing tip **240** may be modified wherein one or more portions of membrane removing tip **240** comprise a plurality of micropillars and then membrane removing tip **240** may be modified to manufacture membrane removing tip **240**. Illustratively, one or more portions of membrane removing tip **240** may comprise a plurality of micropillars. In one or more embodiments, membrane removing tip **240** may be modified, e.g., by an electric discharge machine, to manufacture membrane removing tip **240** and then membrane removing tip **240** may be modified, e.g., by deep reactive-ion etching, wherein one or more portions of membrane removing tip **240** comprise a plurality of micropillars.

Illustratively, abrasive surface **410** may comprise a plurality of micropillars, e.g., abrasive surface **410** may comprise one or more micropillar arrays. In one or more embodiments, abrasive surface **410** may comprise a plurality of micropillars having micropillar diameters in a range of 5.0 to 25.0 micrometers, e.g., abrasive surface **410** may comprise a plurality of micropillars having micropillar diameters of 15.0 micrometers. In one or more embodiments, abrasive surface **410** may comprise a plurality of micropillars having micropillar diameters less than 5.0 micrometers or greater than 25.0 micrometers. Illustratively, abrasive surface **410** may comprise a plurality of micropillars having micropillar heights in a range of 0.25 to 3.0 micrometers, e.g., abrasive surface **410** may comprise a plurality of micropillars having micropillar heights of 2.25 micrometers. In one or more

embodiments, abrasive surface **410** may comprise a plurality of micropillars having micropillar heights less than 0.25 micrometers or greater than 3.0 micrometers. Illustratively, abrasive surface **410** may comprise a plurality of micropillars having micropillar heights in a range of 10.0 to 95.0 percent of the average thickness of an internal limiting membrane, e.g., abrasive surface **410** may comprise a plurality of micropillars having micropillar heights of 80.0 percent of the average thickness of an internal limiting membrane. In one or more embodiments, abrasive surface **410** may comprise a plurality of micropillars having micropillar orientations normal to a portion of a surface of membrane removing tip **240**. Illustratively, abrasive surface **410** may comprise a plurality of micropillars having micropillar orientations at an angle relative to a portion of a surface of membrane removing tip **240**. In one or more embodiments, abrasive surface **410** may comprise a plurality of micropillars having micropillar orientations at an angle in a range of 60.0 to 89.0 degrees relative to a portion of a surface of membrane removing tip **240**, e.g., abrasive surface **410** may comprise a plurality of micropillars having micropillar orientations at an angle of 85.0 degrees relative to a portion of a surface of membrane removing tip **240**. Illustratively, abrasive surface **410** may comprise a plurality of micropillars having micropillar orientations at an angle less than 60.0 degrees or greater than 89.0 degrees relative to a portion of a surface of membrane removing tip **240**.

FIGS. **5**A, **5**B, **5**C, **5**D, **5**E, and **5**F are schematic diagrams illustrating a portion of a surgical procedure. FIG. **5**A illustrates a cannula approach **500**. Illustratively, a surgeon may maneuver an assembled instrument **300** towards an eye **560** to perform a portion of a surgical procedure, e.g., a surgeon may maneuver an assembled instrument **300** towards a cannula **570** to perform a portion of a surgical procedure. In one or more embodiments, cannula **570** may comprise a cannula distal end **571** and a cannula proximal end **572**. Illustratively, cannula **570** may be disposed within an incision in eye **560**, e.g., cannula **570** may be disposed within an incision in eye **560** wherein cannula distal end **571** extends out from an outer surface of eye **560** and cannula proximal end **572** is disposed within an inner eye **565**. In one or more embodiments, a cannula approach **500** may comprise an attempt to guide tip stabilization mechanism proximal end **112** towards cannula distal end **571**.

FIG. **5**B illustrates a cannula contact **510**. Illustratively, a surgeon may approach cannula **570** with assembled instrument **300** until a portion of assembled instrument **300** contacts a portion of cannula **570**, e.g., a surgeon may approach cannula **570** with assembled instrument **300** until tip stabilization mechanism proximal end **112** contacts cannula distal end **571**. In one or more embodiments, a cannula contact **510** may comprise a contact between tip stabilization mechanism proximal end **112** and cannula distal end **571**. Illustratively, a cannula contact **510** may be configured to apply a force to fixation mechanism **130**, e.g., a cannula contact **510** may apply a normal force to tip stabilization mechanism **110**. In one or more embodiments, an application of a normal force to tip stabilization mechanism **110** may be configured to retract tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., a normal force applied to tip stabilization mechanism **110** may be greater than a static friction force between fixation mechanism **130** and hypodermic tube **230**. Illustratively, an application of a normal force to tip stabilization mechanism **110** may not be configured to retract tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., a normal force applied to tip stabilization mechanism **110** may be less than a static friction force between fixation mechanism **130** and hypodermic tube **230**.

FIG. **5**C illustrates a partial membrane removing tip insertion **520**. Illustratively, a surgeon may guide a portion of assembled instrument **300** into cannula **570**, e.g., by advancing handle **210** towards eye **560** after a cannula contact **510**. In one or more embodiments, advancing handle **210** towards eye **560** after a cannula contact **510** may be configured to apply a force to tip stabilization mechanism proximal end **112**. Illustratively, an application of a force to tip stabilization mechanism proximal end **112** may be configured to actuate tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., an application of a force to tip stabilization mechanism proximal end **112** may be configured to actuate tip stabilization mechanism distal end **111** towards handle distal end **211**. In one or more embodiments, advancing handle **210** towards eye **560** after a cannula contact **510** may be configured to apply a force to tip stabilization mechanism **110** that is greater than a static friction force between fixation mechanism **130** and hypodermic tube **230**. Illustratively, advancing handle **210** towards eye **560** after a cannula contact **510** may be configured to retract tip stabilization mechanism **110** and fixation mechanism **130** relative to hypodermic tube **230**. In one or more embodiments, advancing handle **210** towards eye **560** after a cannula contact **510** may actuate membrane removing tip distal end **241** into cannula distal end **571**. Illustratively, advancing handle **210** towards eye **560** after a cannula contact **510** may be configured to actuate hypodermic tube distal end **231** into cannula distal end **571**. In one or more embodiments, advancing handle **210** towards eye **560** after a cannula contact **510** may be configured to actuate membrane removing tip distal end **271** out from cannula proximal end **572**. Illustratively, advancing handle **210** towards eye **560** after a cannula contact **510** may be configured to actuate hypodermic tube distal end **231** out from cannula proximal end **572**. In one or more embodiments, advancing handle **210** towards eye **560** after a cannula contact **510** may be configured to actuate membrane removing tip **240** into inner eye **565**.

FIG. **5**D illustrates a complete membrane removing tip insertion **530**. In one or more embodiments, advancing handle **210** towards eye **560** after a partial membrane removing tip insertion **520** may be configured to apply a force to tip stabilization mechanism proximal end **112**. Illustratively, an application of a force to tip stabilization mechanism proximal end **112** may be configured to actuate tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., an application of a force to tip stabilization mechanism proximal end **112** may be configured to actuate tip stabilization mechanism distal end **111** towards handle distal end **211**. In one or more embodiments, advancing handle **210** towards eye **560** after a partial membrane removing tip insertion **520** may be configured to apply a force to tip stabilization mechanism **110** that is greater than a static friction force between fixation mechanism **130** and hypodermic tube **230**. Illustratively, advancing handle **210** towards eye **560** after a partial membrane removing tip insertion **520** may be configured to retract tip stabilization mechanism **110** and fixation mechanism **130** relative to hypodermic tube **230**. In one or more embodiments, advancing handle **210** towards eye **560** after a partial membrane removing tip insertion **520** may be configured to actuate membrane removing tip **240** within inner eye **565**.

FIG. **5**E illustrates a partial membrane removing tip extraction **540**. Illustratively, a surgeon may guide a portion

of assembled instrument **300** out from cannula **570**, e.g., by retracting handle **210** away from eye **560** after a complete membrane removing tip insertion **530**. In one or more embodiments, retracting handle **210** away from eye **560** may be configured to reduce a force applied to tip stabilization mechanism **110**. Illustratively, reducing a force applied to tip stabilization mechanism **110** may be configured to fix tip stabilization mechanism **110** and fixation mechanism **130** in a position relative to hypodermic tube **230**. In one or more embodiments, a surgeon may use a distance between tip stabilization mechanism proximal end **112** and cannula distal end **571** as a depth gauge to evaluate a risk associated with a surgical procedure, e.g., during a difficult membrane removal, a surgeon may be concerned about damaging a patient's retinal tissue. Illustratively, a surgeon may use a distance between tip stabilization mechanism proximal end **112** and cannula distal end **571** as a depth gauge to compare a depth into the posterior segment of inner eye **565** of a particular portion of a surgical procedure with a depth into the posterior segment of inner eye **565** of a prior portion of a surgical procedure. For example, if a surgeon notices that a first attempt to raise a membrane from a retinal tissue causes damage to the retinal tissue, then the surgeon may note a depth of the first attempt to raise the membrane by observing a relative distance between tip stabilization mechanism proximal end **112** and cannula distal end **571**. Illustratively, the surgeon may make a second attempt to raise the membrane from the retinal tissue at a depth less than the depth of the first attempt to raise the membrane from the retinal tissue by preventing a contact between tip stabilization mechanism proximal end **112** and cannula distal end **571**.

FIG. **5**F illustrates a complete membrane removing tip extraction **550**. Illustratively, a surgeon may guide a portion of assembled instrument **300** out from cannula **570**, e.g., by retracting handle **210** away from eye **560** after a partial membrane removing tip extraction **540**. In one or more embodiments, retracting handle **210** away from eye **560** after a partial membrane removing tip extraction **540** may be configured to extract membrane removing tip **240** from cannula **570**. Illustratively, after a complete membrane removing tip extraction **550**, tip stabilization mechanism **110** may be fixed in a position relative to hypodermic tube **230**, e.g., assembled instrument **300** may comprise an exposed membrane removing tip **400** after a complete membrane removing tip extraction **550**. In one or more embodiments, a surgeon may prepare assembled instrument **300** for a second cannula approach **500** after a complete membrane removing tip extraction **550** by grasping tip stabilization mechanism **110** and actuating tip stabilization mechanism **110** relative to hypodermic tube **230** towards membrane removing tip **240**. Illustratively, a surgeon may prepare assembled instrument **300** for a second cannula approach **500** after a complete membrane removing tip extraction **550** by actuating tip stabilization mechanism **110** over membrane removing tip **240**.

FIG. **6** is a schematic diagram illustrating an exploded view of an irrigating and aspirating instrument assembly **600**. In one or more embodiments, an irrigating and aspirating instrument assembly may comprise a tip stabilization mechanism **110**, a fixation mechanism **130**, a hypodermic tube **230**, a flow control mechanism **610**, a pressure vent tactile locater **620**, a fluid guide **630**, and an irrigating and aspirating tip **640**. Illustratively, flow control mechanism **610** may comprise a flow control mechanism distal end **611**, a flow control mechanism proximal end **612**, and a pressure vent **615**. In one or more embodiments, flow control mechanism **610** may be manufactured from any suitable material, e.g., polymers, metals, metal alloys, etc., or from any combination of suitable materials. Illustratively, fluid guide **630** may comprise a fluid guide distal end **631**, a fluid guide proximal end **632**, a distal locking lip **633**, a proximal locking lip **634**, and a locking depression **635**. In one or more embodiments, fluid guide **630** may be manufactured from any suitable material, e.g., polymers, metals, metal alloys, etc., or from any combination of suitable materials. Illustratively, irrigating and aspirating tip **640** may comprise an irrigating and aspirating tip distal end **641** and an irrigating and aspirating tip proximal end **642**. In one or more embodiments, irrigating and aspirating tip **640** may be manufactured from any suitable material, e.g., polymers, metals, metal alloys, etc., or from any combination of suitable materials. Illustratively, irrigating and aspirating tip **640** may be manufactured from silicone, e.g., biocompatible silicone. In one or more embodiments, irrigating and aspirating tip **640** may comprise an inner lumen for irrigation of fluids. Illustratively, irrigating and aspirating tip **640** may comprise an inner lumen for aspiration of fluids. In one or more embodiments, irrigating and aspirating tip **640** may comprise an inner lumen for irrigation of fluids and for aspiration of fluids.

FIGS. **7**A and **7**B are schematic diagrams illustrating an assembled irrigating and aspirating instrument **700**. FIG. **7**A illustrates a top view of an assembled irrigating and aspirating instrument **700**. In one or more embodiments, fixation mechanism **130** may be disposed over a portion of tip stabilization mechanism **110**, e.g., fixation mechanism **130** may be disposed between tip stabilization mechanism distal end **111** and tip stabilization mechanism proximal end **112**. Illustratively, a portion of fixation mechanism **130** may be disposed within a portion of tip stabilization mechanism **110**, e.g., a portion of fixation mechanism **130** may be disposed within fixation mechanism channel **115**. In one or more embodiments, a portion of fixation mechanism **130** may be disposed within inner bore **120**. Illustratively, a portion of fixation mechanism **130** may be fixed to a portion of tip stabilization mechanism **110**, e.g., fixation mechanism inner diameter **136** may be fixed to a portion of tip stabilization mechanism **110**. In one or more embodiments, a portion of fixation mechanism **130** may be fixed to a portion of tip stabilization mechanism **110** by a force of friction or by any suitable fixation means, e.g., a portion of fixation mechanism **130** may be fixed to a portion of tip stabilization mechanism **110** by an adhesive, a weld, etc.

Illustratively, tip stabilization mechanism **110** may be disposed over a portion of hypodermic tube **230**, e.g., tip stabilization mechanism distal end **111** may be disposed is over hypodermic tube distal end **231**. In one or more embodiments, a portion of hypodermic tube **230** may be disposed within inner bore **120**, e.g., hypodermic tube distal end **231** may be disposed within inner bore **120**. Illustratively, hypodermic tube **230** may be disposed within fixation mechanism **130**, e.g., hypodermic tube **230** may be disposed within fixation mechanism inner diameter **136**. In one or more embodiments, hypodermic tube **230** may not be disposed within fixation mechanism **130**, e.g., a portion of hypodermic tube **230** may be disposed adjacent to a portion of fixation mechanism **130**. Illustratively, fixation mechanism **130** may be configured to temporarily fix tip stabilization mechanism **110** in a position relative to hypodermic tube **230**, e.g., a static friction force between fixation mechanism **130** and hypodermic tube **230** may be configured to temporarily fix tip stabilization mechanism **110** in a position relative to hypodermic tube **230**. In one or more embodi-

ments, a contact between a portion of fixation mechanism **130** and a portion of hypodermic tube **230** may be configured to temporarily fix tip stabilization mechanism **110** in a position relative to hypodermic tube **230**. Illustratively, fixation mechanism **130** may be fixed to both tip stabilization mechanism **110** and hypodermic tube **230** wherein a static friction force between fixation mechanism **130** and hypodermic tube **230** may be configured to temporarily fix tip stabilization mechanism **110** in a position relative to hypodermic tube **230**.

Illustratively, a portion of irrigating and aspirating tip **640** may be disposed within hypodermic tube **230**, e.g., irrigating and aspirating tip proximal end **642** may be disposed within hypodermic tube distal end **231**. In one or more embodiments, a portion of irrigating and aspirating tip **640** may be disposed within hypodermic tube **230** wherein a portion of irrigating and aspirating tip **640** extends from a portion of hypodermic tube **230**, e.g., a portion of irrigating and aspirating tip **640** may be disposed within hypodermic tube **230** wherein irrigating and aspirating tip distal end **641** extends from hypodermic tube distal end **231**. Illustratively, a portion of irrigating and aspirating tip **640** may be fixed within hypodermic tube **230**, e.g., irrigating and aspirating tip proximal end **642** may be fixed within hypodermic tube **230**. In one or more embodiments, a portion of irrigating and aspirating tip **640** may be fixed within hypodermic tube **230** by an adhesive or any suitable fixation means, e.g., a portion of irrigating and aspirating tip **640** may be fixed within hypodermic tube **230** by a friction fit, a weld, etc.

Illustratively, pressure vent tactile locater **620** may be disposed over a portion of flow control mechanism **610**, e.g., pressure vent tactile locater **620** may be disposed over pressure vent **615**. In one or more embodiments, pressure vent tactile locater **620** may be fixed to a portion of flow control mechanism **610** by an adhesive or any suitable fixation means. Illustratively, pressure vent tactile locater **620** may be configured to allow a surgeon to tactilely identify a location of pressure vent **615** where visual identification of a location of pressure vent **615** is impractical, e.g., in a dark operating room. In one or more embodiments, pressure vent tactile locater **620** may be configured to indicate one or more properties of assembled irrigating and aspirating instrument **700** to a surgeon, a nurse, or a surgical technician, e.g., pressure vent tactile locater **620** may comprise a color or a marking configured to visually indicate a minimum cannula gauge size that hypodermic tube **230** may ingress to perform a surgical procedure. Illustratively, pressure vent tactile locater **620** may be manufactured from any suitable material, e.g., polymers, metals, metal alloys, etc., or from any combination of suitable materials.

FIG. **7**B illustrates a cross-sectional view of an assembled irrigating and aspirating instrument **700**. Illustratively, assembled irrigating and aspirating instrument **700** may comprise a fluid chamber **710**, a fluid conduit **720**, an irrigation taper **730**, and a hypodermic tube housing **740**. In one or more embodiments, a portion of fluid guide **630** may be disposed within flow control mechanism **610**, e.g., fluid guide proximal end **632** may be disposed within flow control mechanism **610**. Illustratively, a portion of fluid guide **630** may be fixed within a flow control mechanism **610** by any suitable fixation mechanism, e.g., a portion of fluid guide **630** may be fixed within flow control mechanism **610** by an adhesive, a friction fit, a locking fit, a weld, etc. In one or more embodiments a portion of hypodermic tube **230** may be disposed within a portion of fluid guide **630**, e.g., hypodermic tube proximal end **232** may be disposed within hypodermic tube housing **740**. Illustratively, a portion of hypodermic tube **230** may be fixed within hypodermic tube housing **740** by any suitable fixation mechanism, e.g., a portion of hypodermic tube **230** may be fixed within hypodermic tube housing **740** by a press-fit, an adhesive, a weld, etc.

Illustratively, irrigating and aspirating tip **640** may be disposed within hypodermic tube **230** and tip stabilization mechanism **110**, e.g., irrigating and aspirating tip distal end **641** may be disposed between tip stabilization mechanism distal end **111** and tip stabilization mechanism proximal end **112**. In one or more embodiments, irrigating and aspirating tip **640** may be disposed within hypodermic tube **230** and tip stabilization mechanism **110** wherein irrigating and aspirating tip proximal end **642** may be disposed between hypodermic tube distal end **231** and hypodermic tube proximal end **232**. Illustratively, hypodermic tube **230** may be disposed within tip stabilization mechanism **110** wherein hypodermic tube distal end **231** is disposed between tip stabilization mechanism distal end **111** and tip stabilization mechanism proximal end **112**.

FIG. **8** is a schematic diagram illustrating an exposed irrigating and aspirating tip **800**. In one or more embodiments, irrigating and aspirating tip **640** may be colored black, e.g., to enhance visualization of irrigating and aspirating tip **640**. For example, irrigating and aspirating tip **640** may be manufactured from black silicone to enhance visualization of irrigating and aspirating tip **640**. Illustratively, irrigating and aspirating tip **640** may be colored any color not contained within Johannes Itten's color wheel to enhance visualization of irrigating and aspirating tip **640**, e.g., irrigating and aspirating tip **640** may be colored black or grey to enhance visualization of irrigating and aspirating tip **640**. In one or more embodiments, irrigating and aspirating tip **640** may be configured to irrigate fluid into inner eye **565**. Illustratively, irrigating and aspirating tip **640** may be configured to aspirate fluid out from inner eye **565**. In one or more embodiments, irrigating and aspirating tip **640** may be configured to both irrigate fluid into inner eye **565** and to aspirate fluid out from inner eye **565**.

FIGS. **9**A, **9**B, **9**C, **9**D, **9**E, and **9**F are schematic diagrams illustrating a portion of a surgical procedure. FIG. **9**A illustrates a cannula approach **900**. Illustratively, a surgeon may maneuver an assembled irrigating and aspirating instrument **700** towards an eye **560** to perform a portion of a surgical procedure, e.g., a surgeon may maneuver an assembled irrigating and aspirating instrument **700** towards a cannula **570** to perform a portion of a surgical procedure. In one or more embodiments, cannula **570** may comprise a cannula distal end **571** and a cannula proximal end **572**. Illustratively, cannula **570** may be disposed within an incision in eye **560**, e.g., cannula **570** may be disposed within an incision in eye **560** wherein cannula distal end **571** extends out from an outer surface of eye **560** and cannula proximal end **572** is disposed within an inner eye **565**. In one or more embodiments, a cannula approach **900** may comprise an attempt to guide tip stabilization mechanism proximal end **112** towards cannula distal end **571**.

FIG. **9**B illustrates a cannula contact **910**. Illustratively, a surgeon may approach cannula **570** with assembled irrigating and aspirating instrument **700** until a portion of assembled irrigating and aspirating instrument **700** contacts a portion of cannula **570**, e.g., a surgeon may approach cannula **570** with assembled irrigating and aspirating instrument **700** until tip stabilization mechanism proximal end **112** contacts cannula distal end **571**. In one or more embodiments, a cannula contact **510** may comprise a contact between tip stabilization mechanism proximal end **112** and

cannula distal end **571**. Illustratively, a cannula contact **510** may be configured to apply a force to fixation mechanism **130**, e.g., a cannula contact **510** may apply a normal force to tip stabilization mechanism **110**. In one or more embodiments, an application of a normal force to tip stabilization mechanism **110** may be configured to retract tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., a normal force applied to tip stabilization mechanism **110** may be greater than a static friction force between fixation mechanism **130** and hypodermic tube **230**. Illustratively, an application of a normal force to tip stabilization mechanism **110** may not be configured to retract tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., a normal force applied to tip stabilization mechanism **110** may be less than a static friction force between fixation mechanism **130** and hypodermic tube **230**.

FIG. **9**C illustrates a partial irrigating and aspirating tip insertion **920**. Illustratively, a surgeon may guide a portion of assembled irrigating and aspirating instrument **700** into cannula **570**, e.g., by advancing flow control mechanism **610** towards eye **560** after a cannula contact **510**. In one or more embodiments, advancing flow control mechanism **610** towards eye **560** after a cannula contact **510** may be configured to apply a force to tip stabilization mechanism proximal end **112**. Illustratively, an application of a force to tip stabilization mechanism proximal end **112** may be configured to actuate tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., an application of a force to tip stabilization mechanism proximal end **112** may be configured to actuate tip stabilization mechanism distal end **111** towards handle distal end **211**. In one or more embodiments, advancing flow control mechanism **610** towards eye **560** after a cannula contact **510** may be configured to apply a force to tip stabilization mechanism **110** that is greater than a static friction force between fixation mechanism **130** and hypodermic tube **230**. Illustratively, advancing flow control mechanism **610** towards eye **560** after a cannula contact **510** may be configured to retract tip stabilization mechanism **110** and fixation mechanism **130** relative to hypodermic tube **230**. In one or more embodiments, advancing flow control mechanism **610** towards eye **560** after a cannula contact **510** may actuate irrigating and aspirating tip distal end **641** into cannula distal end **571**. Illustratively, advancing flow control mechanism **610** towards eye **560** after a cannula contact **510** may be configured to actuate hypodermic tube distal end **231** into cannula distal end **571**. In one or more embodiments, advancing flow control mechanism **610** towards eye **560** after a cannula contact **510** may be configured to actuate irrigating and aspirating tip distal end **641** out from cannula proximal end **572**. Illustratively, advancing flow control mechanism **610** towards eye **560** after a cannula contact **510** may be configured to actuate hypodermic tube distal end **231** out from cannula proximal end **572**. In one or more embodiments, advancing flow control mechanism **610** towards eye **560** after a cannula contact **510** may be configured to actuate irrigating and aspirating tip **640** into inner eye **565**.

FIG. **9**D illustrates a complete irrigating and aspirating tip insertion **930**. In one or more embodiments, advancing flow control mechanism **610** towards eye **560** after a partial irrigating and aspirating tip insertion **920** may be configured to apply a force to tip stabilization mechanism proximal end **112**. Illustratively, an application of a force to tip stabilization mechanism proximal end **112** may be configured to actuate tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., an application of a force to tip stabilization mechanism proximal end **112** may be configured to actuate tip stabilization mechanism distal end **111** towards fluid guide distal end **631**. In one or more embodiments, advancing flow control mechanism **610** towards eye **560** after a partial irrigating and aspirating tip insertion **920** may be configured to apply a force to tip stabilization mechanism **110** that is greater than a static friction force between fixation mechanism **130** and hypodermic tube **230**. Illustratively, advancing flow control mechanism **610** towards eye **560** after a partial irrigating and aspirating tip insertion **920** may be configured to retract tip stabilization mechanism **110** and fixation mechanism **130** relative to hypodermic tube **230**. In one or more embodiments, advancing flow control mechanism **610** towards eye **560** after a partial irrigating and aspirating tip insertion **920** may be configured to actuate irrigating and aspirating tip **640** within inner eye **565**.

FIG. **9**E illustrates a partial irrigating and aspirating tip extraction **940**. Illustratively, a surgeon may guide a portion of assembled irrigating and aspirating instrument **700** out from cannula **570**, e.g., by retracting flow control mechanism **610** away from eye **560** after a complete irrigating and aspirating tip insertion **930**. In one or more embodiments, retracting flow control mechanism **610** away from eye **560** may be configured to reduce a force applied to tip stabilization mechanism **110**. Illustratively, reducing a force applied to tip stabilization mechanism **110** may be configured to fix tip stabilization mechanism **110** and fixation mechanism **130** in a position relative to hypodermic tube **230**. In one or more embodiments, a surgeon may use a distance between tip stabilization mechanism proximal end **112** and cannula distal end **571** as a depth gauge to evaluate a risk associated with a surgical procedure, e.g., during a difficult membrane removal, a surgeon may be concerned about damaging a patient's retinal tissue. Illustratively, a surgeon may use a distance between tip stabilization mechanism proximal end **112** and cannula distal end **571** as a depth gauge to compare a depth into the posterior segment of inner eye **565** of a particular portion of a surgical procedure with a depth into the posterior segment of inner eye **565** of a prior portion of a surgical procedure.

FIG. **9**F illustrates a complete irrigating and aspirating tip extraction **950**. Illustratively, a surgeon may guide a portion of assembled irrigating and aspirating instrument **700** out from cannula **570**, e.g., by retracting flow control mechanism **610** away from eye **560** after a partial irrigating and aspirating tip extraction **940**. In one or more embodiments, retracting flow control mechanism **610** away from eye **560** after a partial irrigating and aspirating tip extraction **940** may be configured to extract irrigating and aspirating tip **610** from cannula **570**. Illustratively, after a complete irrigating and aspirating tip extraction **950**, tip stabilization mechanism **110** may be fixed in a position relative to hypodermic tube **230**, e.g., assembled irrigating and aspirating instrument **700** may comprise an exposed irrigating and aspirating tip **800** after a complete irrigating and aspirating tip extraction **950**. In one or more embodiments, a surgeon may prepare assembled irrigating and aspirating instrument **700** for a second cannula approach **900** after a complete irrigating and aspirating tip extraction **950** by grasping tip stabilization mechanism **110** and actuating tip stabilization mechanism **110** relative to hypodermic tube **230** towards irrigating and aspirating tip **640**. Illustratively, a surgeon may prepare assembled irrigating and aspirating instrument **700** for a second cannula approach **900** after a complete irrigating and aspirating tip extraction **950** by actuating tip stabilization mechanism **110** over irrigating and aspirating tip **640**.

FIGS. **10**A, **10**B, **10**C, **10**D, and **10**E are schematic diagrams illustrating a portion of a surgical procedure. FIG.

10A illustrates a valved cannula approach **1000**. Illustratively, a valved cannula **1050** may comprise an inner lumen **1055**, a first valve hinge **1065**, a second valve hinge **1065**, and a valve hinge interface **1060**. In one or more embodiments, first valve hinge **1065** may comprise a first valve hinge superior surface **1066** and second valve hinge **1065** may comprise a second valve hinge superior surface **1066**. Illustratively, valved cannula **1050** may be configured to maintain an intraocular pressure, e.g., valve hinge interface **1060** may be configured to maintain an intraocular pressure during a surgical procedure. In one or more embodiments, a surgeon may guide tip stabilization mechanism **110** towards valved cannula **1050** to perform a portion of a surgical procedure, e.g., a surgeon may guide tip stabilization mechanism proximal end **112** towards valve hinge superior surface **1066** to perform a portion of a surgical procedure. Illustratively, as a surgeon guides tip stabilization mechanism proximal end **112** towards valve hinge superior surface **1066**, hypodermic tube distal end **231** may be disposed within tip stabilization mechanism inner bore **120**. In one or more embodiments, as a surgeon guides tip stabilization mechanism proximal end **112** towards valve hinge superior surface **1066**, membrane removing tip distal end **241** may be disposed within tip stabilization mechanism inner bore **120**.

FIG. **10**B illustrates a valved cannula contact **1010**. In one or more embodiments, a valved cannula contact **1010** may comprise a contact between a portion of tip stabilization mechanism **110** and a portion of valved cannula **1050**, e.g., a valved cannula contact **1010** may comprise a contact between tip stabilization mechanism proximal end **112** and valve hinge superior surface **1066**. Illustratively, a valved cannula contact **1010** may be configured to apply a force to fixation mechanism **130**, e.g., a valved cannula contact **1010** may apply a normal force to tip stabilization mechanism **110**. In one or more embodiments, an application of a normal force to tip stabilization mechanism **110** may be configured to retract tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., a normal force applied to tip stabilization mechanism **110** may be greater than a static friction force between fixation mechanism **130** and hypodermic tube **230**. Illustratively, an application of a normal force to tip stabilization mechanism **110** may not be configured to retract tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., a normal force applied to tip stabilization mechanism **110** may be less than a static friction force between fixation mechanism **130** and hypodermic tube **230**.

FIG. **10**C illustrates a membrane removing tip stabilization **1020**. Illustratively, a surgeon may actuate hypodermic tube **230** towards inner lumen **1055** after a valved cannula contact **1010**, e.g., a surgeon may actuate hypodermic tube distal end **231** towards inner lumen **1055** after a valved cannula contact **1010**. In one or more embodiments, actuating hypodermic tube **230** towards inner lumen **1055** after a valved cannula contact **1010** may be configured to apply a force to tip stabilization mechanism **110**, e.g., actuating hypodermic tube distal end **231** towards inner lumen **1055** after a valved cannula contact **1010** may be configured to apply a force to tip stabilization mechanism proximal end **112**. Illustratively, an application of a force to tip stabilization mechanism **110** may be configured to actuate tip stabilization mechanism **110** relative to housing tube **230**, e.g., an application of a force to tip stabilization mechanism proximal end **112** that is greater than a force of static friction between fixation mechanism **130** and hypodermic tube **230** may be configured to retract tip stabilization mechanism **110** relative to hypodermic tube **230**. Illustratively, an application of a force to tip stabilization mechanism proximal end **112** may be configured to actuate tip stabilization mechanism distal end **111** towards hypodermic tube proximal end **232**. In one or more embodiments, an actuation of tip stabilization mechanism **110** relative to housing tube **230** may be configured to expose a portion of membrane removing tip **240**, e.g., an actuation of tip stabilization mechanism distal end **111** towards hypodermic tube proximal end **232** may be configured to expose membrane removing tip distal end **241**. Illustratively, an exposure of a portion of membrane removing tip **240** may be configured to facilitate a contact between membrane removing tip **240** and valve hinge superior surface **1066**, e.g., an exposure of a portion of membrane removing tip **240** may be configured to facilitate a contact between membrane removing tip distal end **241** and valve hinge superior surface **1066**. In one or more embodiments, as a surgeon actuates hypodermic tube distal end **231** towards inner lumen **1055**, a contact between membrane removing tip **240** and valve hinge superior surface **1066** may be configured to cause membrane removing tip **240** to deform, e.g., a contact between membrane removing tip **240** and valve hinge superior surface **1066** may be configured to cause membrane removing tip **240** to bend or flex. Illustratively, a contact between membrane removing tip **240** and valve hinge superior surface **1066** may be configured to cause an elastic deformation of membrane removing tip **240**. In one or more embodiments, a contact between membrane removing tip **240** and valve hinge superior surface **1066** may be configured to cause a plastic deformation of membrane removing tip **240**.

Illustratively, tip stabilization mechanism **110** may be configured to facilitate a membrane removing tip deformation prevention **1070**, e.g., tip stabilization mechanism inner diameter **114** may be configured to prevent membrane removing tip **240** from deforming. In one or more embodiments, tip stabilization mechanism **110** may be configured to prevent a portion of membrane removing tip **240** from deforming beyond a line tangent to a wall of inner lumen **1055**, e.g., tip stabilization mechanism inner diameter **114** may be configured to prevent a portion of membrane removing tip **240** from deforming beyond a line tangent to a wall of inner lumen **1055**. For example, tip stabilization mechanism **110** may be configured to prevent a portion of membrane removing tip **240** from bending or flexing beyond a line tangent to a wall of inner lumen **1055**. Illustratively, tip stabilization mechanism **110** may be configured to prevent a portion of membrane removing tip **240** from deforming beyond a line tangent to an outer diameter of valved cannula **1050**, e.g., tip stabilization mechanism inner diameter **114** may be configured to prevent a portion of membrane removing tip **240** from deforming beyond a line tangent to an outer diameter of valved cannula **1050**. For example, tip stabilization mechanism **110** may be configured to prevent a portion of membrane removing tip **240** from bending or flexing beyond a line tangent to an outer diameter of valved cannula **1050**. In one or more embodiments, a membrane removing tip deformation prevention **1070** may be configured to actuate valve hinge **1065**, e.g., a membrane removing tip deformation prevention **1070** may be configured to separate a first valve hinge **1065** and a second valve hinge **1065** at valve hinge interface **1060**. Illustratively, a membrane removing tip deformation prevention **1070** may be configured to guide a portion of membrane removing tip **240** into inner lumen **1055**, e.g., a membrane removing tip deformation prevention **1070** may be configured to guide membrane removing tip distal end **241** into inner lumen **1055**. In one or more embodiments, membrane removing tip **240** may have a first stiffness, valve hinge **1065** may have a

second stiffness, and tip stabilization mechanism **110** may have a third stiffness wherein the second stiffness is greater than the first stiffness and the third stiffness is greater than the second stiffness. Illustratively, the second stiffness of valve hinge **1065** may be configured to cause a deformation of membrane removing tip **240** and the third stiffness of tip stabilization mechanism **110** may be configured to guide a portion of membrane removing tip **240** into inner lumen **1055**.

FIG. **10**D illustrates a partial valved cannula ingress **1030**. Illustratively, a surgeon may actuate hypodermic tube **230** towards inner lumen **1055** after a membrane removing tip stabilization **1020**, e.g., a surgeon may actuate hypodermic tube distal end **231** towards inner lumen **1055** after a membrane removing tip stabilization **1020**. In one or more embodiments, an actuation of hypodermic tube distal end **231** towards inner lumen **1055** after a membrane removing tip stabilization **1020** may be configured to actuate a portion of membrane removing tip **240** into valved cannula **1050**, e.g., an actuation of hypodermic tube distal end **231** towards inner lumen **1055** after a membrane removing tip stabilization **1020** may be configured to actuate membrane removing tip distal end **241** into inner lumen **1055**. Illustratively, an actuation of hypodermic tube distal end **231** towards inner lumen **1055** after a membrane removing tip stabilization **1020** may be configured to actuate abrasive surface **410** into inner lumen **1055**. In one or more embodiments, an actuation of hypodermic tube distal end **231** towards inner lumen **1055** after a membrane removing tip stabilization **1020** may be configured to increase a separation of a first valve hinge **1065** and a second valve hinge **1065**. Illustratively, an actuation of hypodermic tube distal end **231** towards inner lumen **1055** after a membrane removing tip stabilization **1020** may be configured to cause membrane removing tip **240** to return to its original geometry, e.g., an actuation of hypodermic tube distal end **231** towards inner lumen **1055** after a membrane removing tip stabilization **1020** may be configured to cause membrane removing tip **240** to return to its pre-deformation geometry.

FIG. **10**E illustrates a complete valved cannula ingress **1040**. Illustratively, a surgeon may actuate hypodermic tube **230** towards inner lumen **1055** after a partial valved cannula ingress **1030**, e.g., a surgeon may actuate hypodermic tube distal end **231** into inner lumen **1055** after a partial valved cannula ingress **1030**. In one or more embodiments, an actuation of hypodermic tube distal end **231** into inner lumen **1055** after a partial valved cannula ingress **1030** may be configured to fully separate a first valve hinge **1065** and a second valve hinge **1065**. Illustratively, an actuation of hypodermic tube distal end **231** into inner lumen **1055** after a partial valved cannula ingress **1030** may be configured to cause a portion of hypodermic tube **230** to contact a portion of valve hinge superior surface **1066**, e.g., an actuation of hypodermic tube distal end **231** into inner lumen **1055** after a partial valved cannula ingress **1030** may be configured to cause an outer portion of hypodermic tube **230** to contact a portion of valve hinge superior surface **1066**.

FIGS. **11**A, **11**B, **11**C, **11**D, and **11**E are schematic diagrams illustrating a portion of a surgical procedure. FIG. **11**A illustrates a valved cannula approach **1100**. In one or more embodiments, a surgeon may guide tip stabilization mechanism **110** towards valved cannula **1050** to perform a portion of a surgical procedure, e.g., a surgeon may guide tip stabilization mechanism proximal end **112** towards valve hinge superior surface **1066** to perform a portion of a surgical procedure. Illustratively, as a surgeon guides tip stabilization mechanism proximal end **112** towards valve hinge superior surface **1066**, hypodermic tube distal end **231** may be disposed within tip stabilization mechanism inner bore **120**. In one or more embodiments, as a surgeon guides tip stabilization mechanism proximal end **112** towards valve hinge superior surface **1066**, irrigating and aspirating tip distal end **641** may be disposed within tip stabilization mechanism inner bore **120**.

FIG. **11**B illustrates a valved cannula contact **1110**. In one or more embodiments, a valved cannula contact **1110** may comprise a contact between a portion of tip stabilization mechanism **110** and a portion of valved cannula **1050**, e.g., a valved cannula contact **1110** may comprise a contact between tip stabilization mechanism proximal end **112** and valve hinge superior surface **1066**. Illustratively, a valved cannula contact **1110** may be configured to apply a force to fixation mechanism **130**, e.g., a valved cannula contact **1110** may apply a normal force to tip stabilization mechanism **110**. In one or more embodiments, an application of a normal force to tip stabilization mechanism **110** may be configured to retract tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., a normal force applied to tip stabilization mechanism **110** may be greater than a static friction force between fixation mechanism **130** and hypodermic tube **230**. Illustratively, an application of a normal force to tip stabilization mechanism **110** may not be configured to retract tip stabilization mechanism **110** relative to hypodermic tube **230**, e.g., a normal force applied to tip stabilization mechanism **110** may be less than a static friction force between fixation mechanism **130** and hypodermic tube **230**.

FIG. **11**C illustrates an irrigating and aspirating tip stabilization **1120**. Illustratively, a surgeon may actuate hypodermic tube **230** towards inner lumen **1055** after a valved cannula contact **1110**, e.g., a surgeon may actuate hypodermic tube distal end **231** towards inner lumen **1055** after a valved cannula contact **1110**. In one or more embodiments, actuating hypodermic tube **230** towards inner lumen **1055** after a valved cannula contact **1110** may be configured to apply a force to tip stabilization mechanism **110**, e.g., actuating hypodermic tube distal end **231** towards inner lumen **1055** after a valved cannula contact **1110** may be configured to apply a force to tip stabilization mechanism proximal end **112**. Illustratively, an application of a force to tip stabilization mechanism **110** may be configured to actuate tip stabilization mechanism **110** relative to housing tube **230**, e.g., an application of a force to tip stabilization mechanism proximal end **112** that is greater than a force of static friction between fixation mechanism **130** and hypodermic tube **230** may be configured to retract tip stabilization mechanism **110** relative to hypodermic tube **230**. Illustratively, an application of a force to tip stabilization mechanism proximal end **112** may be configured to actuate tip stabilization mechanism distal end **111** towards hypodermic tube proximal end **232**. In one or more embodiments, an actuation of tip stabilization mechanism **110** relative to housing tube **230** may be configured to expose a portion of irrigating and aspirating tip **640**, e.g., an actuation of tip stabilization mechanism distal end **111** towards hypodermic tube proximal end **232** may be configured to expose irrigating and aspirating tip distal end **641**. Illustratively, an exposure of a portion of irrigating and aspirating tip **640** may be configured to facilitate a contact between irrigating and aspirating tip **640** and valve hinge superior surface **1066**, e.g., an exposure of a portion of irrigating and aspirating tip **640** may be configured to facilitate a contact between irrigating and aspirating tip distal end **641** and valve hinge superior surface **1066**. In one or more embodiments, as a surgeon actuates hypodermic tube distal end **231** towards

inner lumen **1055**, a contact between irrigating and aspirating tip **640** and valve hinge superior surface **1066** may be configured to cause irrigating and aspirating tip **640** to deform, e.g., a contact between irrigating and aspirating tip **640** and valve hinge superior surface **1066** may be configured to cause irrigating and aspirating tip **640** to bend or flex. Illustratively, a contact between irrigating and aspirating tip **640** and valve hinge superior surface **1066** may be configured to cause an elastic deformation of irrigating and aspirating tip **640**. In one or more embodiments, a contact between irrigating and aspirating tip **640** and valve hinge superior surface **1066** may be configured to cause a plastic deformation of irrigating and aspirating tip **640**.

Illustratively, tip stabilization mechanism **110** may be configured to facilitate an irrigating and aspirating tip deformation prevention **1170**, e.g., tip stabilization mechanism inner diameter **114** may be configured to prevent irrigating and aspirating tip **640** from deforming. In one or more embodiments, tip stabilization mechanism **110** may be configured to prevent a portion of irrigating and aspirating tip **640** from deforming beyond a line tangent to a wall of inner lumen **1055**, e.g., tip stabilization mechanism inner diameter **114** may be configured to prevent a portion of irrigating and aspirating tip **640** from deforming beyond a line tangent to a wall of inner lumen **1055**. For example, tip stabilization mechanism **110** may be configured to prevent a portion of irrigating and aspirating tip **640** from bending or flexing beyond a line tangent to a wall of inner lumen **1055**. Illustratively, tip stabilization mechanism **110** may be configured to prevent a portion of irrigating and aspirating tip **640** from deforming beyond a line tangent to an outer diameter of valved cannula **1050**, e.g., tip stabilization mechanism inner diameter **114** may be configured to prevent a portion of irrigating and aspirating tip **640** from deforming beyond a line tangent to an outer diameter of valved cannula **1050**. For example, tip stabilization mechanism **110** may be configured to prevent a portion of irrigating and aspirating tip **640** from bending or flexing beyond a line tangent to an outer diameter of valved cannula **1050**. In one or more embodiments, an irrigating and aspirating tip deformation prevention **1170** may be configured to actuate valve hinge **1065**, e.g., an irrigating and aspirating tip deformation prevention **1170** may be configured to separate a first valve hinge **1065** and a second valve hinge **1065** at valve hinge interface **1060**. Illustratively, an irrigating and aspirating tip deformation prevention **1170** may be configured to guide a portion of irrigating and aspirating tip **640** into inner lumen **1055**, e.g., a membrane removing tip deformation prevention **1070** may be configured to guide irrigating and aspirating tip distal end **641** into inner lumen **1055**. In one or more embodiments, irrigating and aspirating tip **640** may have a first stiffness, valve hinge **1065** may have a second stiffness, and tip stabilization mechanism **110** may have a third stiffness wherein the second stiffness is greater than the first stiffness and the third stiffness is greater than the second stiffness. Illustratively, the second stiffness of valve hinge **1065** may be configured to cause a deformation of irrigating and aspirating tip **640** and the third stiffness of tip stabilization mechanism **110** may be configured to guide a portion of irrigating and aspirating tip **640** into inner lumen **1055**.

FIG. **11**D illustrates a partial valved cannula ingress **1130**. Illustratively, a surgeon may actuate hypodermic tube **230** towards inner lumen **1055** after an irrigating and aspirating tip stabilization **1120**, e.g., a surgeon may actuate hypodermic tube distal end **231** towards inner lumen **1055** after an irrigating and aspirating tip stabilization **1120**. In one or more embodiments, an actuation of hypodermic tube distal end **231** towards inner lumen **1055** after an irrigating and aspirating tip stabilization **1120** may be configured to actuate a portion of irrigating and aspirating tip **640** into valved cannula **1050**, e.g., an actuation of hypodermic tube distal end **231** towards inner lumen **1055** after an irrigating and aspirating tip stabilization **1120** may be configured to actuate irrigating and aspirating tip distal end **641** into inner lumen **1055**. Illustratively, an actuation of hypodermic tube distal end **231** towards inner lumen **1055** after an irrigating and aspirating tip stabilization **1120** may be configured to increase a separation of a first valve hinge **1065** and a second valve hinge **1065**. Illustratively, an actuation of hypodermic tube distal end **231** towards inner lumen **1055** after an irrigating and aspirating tip stabilization **1120** may be configured to cause irrigating and aspirating tip **640** to return to its original geometry, e.g., an actuation of hypodermic tube distal end **231** towards inner lumen **1055** after an irrigating and aspirating tip stabilization **1120** may be configured to cause irrigating and aspirating tip **640** to return to its pre-deformation geometry.

FIG. **11**E illustrates a complete valved cannula ingress **1140**. Illustratively, a surgeon may actuate hypodermic tube **230** towards inner lumen **1055** after a partial valved cannula ingress **1130**, e.g., a surgeon may actuate hypodermic tube distal end **231** into inner lumen **1055** after a partial valved cannula ingress **1130**. In one or more embodiments, an actuation of hypodermic tube distal end **231** into inner lumen **1055** after a partial valved cannula ingress **1130** may be configured to fully separate a first valve hinge **1065** and a second valve hinge **1065**. Illustratively, an actuation of hypodermic tube distal end **231** into inner lumen **1055** after a partial valved cannula ingress **1130** may be configured to cause a portion of hypodermic tube **230** to contact a portion of valve hinge superior surface **1066**, e.g., an actuation of hypodermic tube distal end **231** into inner lumen **1055** after a partial valved cannula ingress **1130** may be configured to cause an outer portion of hypodermic tube **230** to contact a portion of valve hinge superior surface **1066**.

The foregoing description has been directed to particular embodiments of this invention. It will be apparent; however, that other variations and modifications may be made to the described embodiments, with the attainment of some or all of their advantages. Specifically, it should be noted that the principles of the present invention may be implemented in any system. Furthermore, while this description has been written in terms of a cannula ingress system, the teachings of the present invention are equally suitable to any systems where the functionality may be employed. Therefore, it is the object of the appended claims to cover all such variations and modifications as come within the true spirit and scope of the invention.

What is claimed is:

1. A system comprising:

a hypodermic tube having a hypodermic tube distal end and a hypodermic tube proximal end, the hypodermic tube having dimensions configured for performing ophthalmic surgery;

a tip having a tip distal end and a tip proximal end wherein the tip proximal end is disposed within the hypodermic tube and the tip distal end extends out from the hypodermic tube distal end;

a tip stabilization mechanism having a tip stabilization mechanism distal end and a tip stabilization mechanism proximal end; and

a fixation mechanism disposed over a portion of the tip stabilization mechanism wherein a portion of the fixation mechanism is disposed in a fixation mechanism

channel of the tip stabilization mechanism wherein the tip distal end and the hypodermic tube distal end are disposed within an inner bore of the tip stabilization mechanism and the fixation mechanism is configured to temporarily fix the tip stabilization mechanism in a position relative to the hypodermic tube wherein the tip stabilization mechanism has an outer diameter that is less than an outer diameter of the fixation mechanism.

2. The system of claim **1** wherein the fixation mechanism contacts a portion of the hypodermic needle.

3. The system of claim **2** wherein a static friction force is configured to temporarily fix the tip stabilization mechanism in the position relative to the hypodermic tube.

4. The system of claim **1** wherein the tip stabilization mechanism is configured to prevent the tip from deforming beyond a line tangent to an outer diameter of a valved cannula.

5. The system of claim **4** wherein the tip stabilization mechanism is configured to actuate a first valve hinge of the valved cannula.

6. The system of claim **5** wherein the tip stabilization mechanism is configured to separate the first valve hinge and a second valve hinge at a valve hinge interface.

7. The system of claim **6** wherein the tip stabilization mechanism is configured to guide the tip distal end into an inner lumen of the valved cannula.

8. The system of claim **1** wherein the tip stabilization mechanism is configured to prevent the tip from deforming beyond a line tangent to a wall of an inner lumen of a cannula.

9. The system of claim **1** wherein the tip stabilization mechanism is configured to prevent the tip from deforming after a contact between the tip distal end and a valve hinge superior surface.

10. The system of claim **1** further comprising:

an abrasive surface of the tip configured to grasp a portion of a membrane.

11. The system of claim **10** further comprising:

biocompatible particles of the abrasive surface.

12. The system of claim **11** wherein the tip is colored black to enhance visualization of the biocompatible particles of the abrasive surface.

13. The system of claim **1** wherein the tip is colored black to enhance visualization of the tip.

14. The system of claim **13** wherein the tip is manufactured from black silicone.

15. The system of claim **1** wherein the tip is colored grey to enhance visualization of the tip.

16. The system of claim **1** wherein the tip is colored any color not contained within Johannes Itten's color wheel to enhance visualization of the tip.

17. The system of claim **1** further comprising:

an inner lumen of the tip configured for irrigation of fluids.

18. The system of claim **17** wherein the inner lumen of the tip is configured for aspiration of fluids.

19. The system of claim **1** wherein an application of a force to the tip stabilization mechanism proximal end is configured to actuate the tip stabilization mechanism relative to the hypodermic tube.

20. The system of claim **19** wherein the application of the force to the tip stabilization mechanism proximal end is configured to expose the tip distal end.

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